JULY ★ 1947

American Foundryman

THE
FOUNDRYMEN'S
Own
MAGAZINE

CONTENTS

VOLUME XII, NUMBER 1

American Foundryman

July, 1947

Official publication of American Foundrymen's Association

The American Foundrymen's Association is not responsible for statements or opinions advanced by authors of papers printed in its publication.

This Month's Cover

The chemical composition of materials is constantly growing more complex. Also greater demands are being made in the laboratory on the analyst for speed in his analyses and accuracy in his final results. Here two men eagerly await the end of a chemical analysis test.

Published monthly by the American Foundrymen's Association, Inc., 222 W. Adams St., Chicago 6. Subscription price, to members, $4.00 per year; to non-members, $6.00 per year. Single copies, 50c. Entered as second class matter July 22, 1938, under the Act of March 3, 1879, at the post office, Chicago, Illinois. Additional entry at Ann Arbor, Mich.

SUPPORT THE METAL CASTINGS INDUSTRY THROUGH THE A.F.A.

IT HAS BEEN said that in the correct management of research, engineering and aggressive sales policies lies the formula for a successful business enterprise. Research and engineering, however, must always come first.

Without a basic product, correctly engineered, no sales organization can bring production up to the point that means complete prosperity. On any other basis than lowest costs, correct technical principles and proper application of tested theories, any business is on an unsteady foundation.

As widely as this philosophy has been accepted, it is difficult to understand why it is so generally ignored. Otherwise sound business men are seemingly too busy to back research and pure engineering in prosperous times, and these activities seem to become the first casualties when sales drop off.

The castings industry is no exception to this rule. Even in prosperous times such as these, it seems strange that foundry research should not forge ahead more quickly. The steel, lumber, rubber, welding and forging industries maintain huge programs that dwarf any effort so far made by foundries.

Yet the field for metal castings is tremendous. No method of fabrication is more versatile. None is more desperately needed. None has greater facilities. Certainly none has the technical brains that have been exhibited by our industry.

With notable exception, however, foundries are tolerated rather than promoted. Young engineers are channeled into chemistry, civil engineering and other fields. Management usually refuses the necessary capital for improvement of working conditions. The public in general, which includes the capital that finances business, regards the foundry trade most unpleasantly. Recently I heard of a class of twenty young men in foundry technology which melted away as soon as their mothers learned of their intentions.

What can be done? It seems to me that we have right in our grasp a far-reaching answer . . . a solution so simple that it is really not a solution at all but merely an unexplored source . . . and that is to support completely the A.F.A. and its local chapters.

A.F.A. should be your personal laboratory of creative expression in your work . . . which certainly must be more than just a livelihood. By actively participating you will gain the ideal of service to others engaged in solving the same problems you experience every day. Work out research projects in your own shop and give freely of your ideas and results. Talk foundry and its accomplishments everywhere, and be proud that you have a part in this most creative of trades. Get your superiors interested and keep talking foundry and the American Foundrymen's Association.

Confidence and pride of endeavor will attract the necessary attention. If all 9600 members of A.F.A. could do this the industry could lift itself by its bootstraps and there would soon be 20,000 and then 50,000 technicians, workers, bosses and backers to keep it coming. Change the slogan from *"The Foundry Is A Good Place To Work"* to *"The Foundry Is The Best Place To Work."*

Bruce L. Simpson

BRUCE L. SIMPSON, *National Director*
AMERICAN FOUNDRYMEN'S ASSOCIATION

BRUCE L. SIMPSON *is well known nationally because he is president, National Engineering Co., Chicago; a National Director of the American Foundrymen's Association and Foundry Equipment Manufacturers Association; treasurer of the A.F.A. Chicago chapter and has spoken before practically every A.F.A. chapter. He is a graduate of Northwestern University, Evanston, Ill., and has served as purchasing agent and vice-president of National Engineering.*

Philadelphia

IN 1948

ACTING ON the invitation of the Philadelphia Chapter, the Board of Directors of A.F.A. has unanimously approved staging the 1948 Convention and Exhibit of American Foundrymen's Association in Philadelphia during the week of May 3-7, inclusive. The Exhibit and most Convention meetings will be held in the fine Philadelphia Convention Hall and Commercial Museum, with evening meetings and other events at downtown hotels, as yet unannounced.

This will be the sixth time that A.F.A. has met in Philadelphia--actually, the "home" of A.F.A., since the Association was organized and held its first meeting in that city in 1896. Other meetings were staged there in 1907, 1919, 1928 and the last in 1934. An International Foundry Congress scheduled to be held in 1932 was cancelled early that year because of existing business conditions.

Many factors indicate that the 1948 Annual Meeting will be a popular event from the standpoint of both exhibitor interest and attendance. Pennsylvania, of course, is the largest foundry state in the United States, and the heavy industrial sections within a radius of 500 to 750 miles of Philadelphia includes several thousand foundries. The growing emphasis on mechanization and plant improvements of all kinds for purposes of more economical operation and quality products might easily set new records in attendance.

Philadelphia Convention Hall where the 1948 Foundry Congress and Foundry Show will be held. This will be the 52nd Annual Meeting of the American Foundrymen's Association and the first meeting and exhibit to be held in Philadelphia since that of 1934.

The phenomenal success of the 50th Anniversary Convention and Exhibit at Cleveland in 1946 indicates that a Philadelphia Show will bring out displays of even greater interest. For one thing, the 1946 Show occurred too soon after the end of hostilities for equipment manufacturers to develop to display point those new and improved products which had been long on their drawing boards. By May, 1948, however, many of these projected improvements will have become reality and undoubtedly will be shown next year.

Increasing labor rates, maladjustments in the distribution of supplies, and continuance of high tax rates, in the face of competition from other metal working processes, can be expected to develop high interest on the part of foundry management in the advantages of advanced types of equipment and improved foundry materials. In addition, foundry management is intensely interested today in improving its physical plant so as to attract more young men into foundry work.

Equipment Market Trend

Besides these broad considerations, there is evidence that the demand for equipment and supplies may be approaching a "buyer's market" trend, with greater emphasis on individual product advantages than has been the case for nearly ten years. During this period of time tremendous adjustments of personnel have occurred in the foundry industry as well as in all industries, with the result that foundry personnel today in effect must be re-educated from a sales point of view by companies whose products are or may be utilized in the production of castings.

Attendance at Philadelphia will not be confined solely to foundrymen of North America, as evidenced

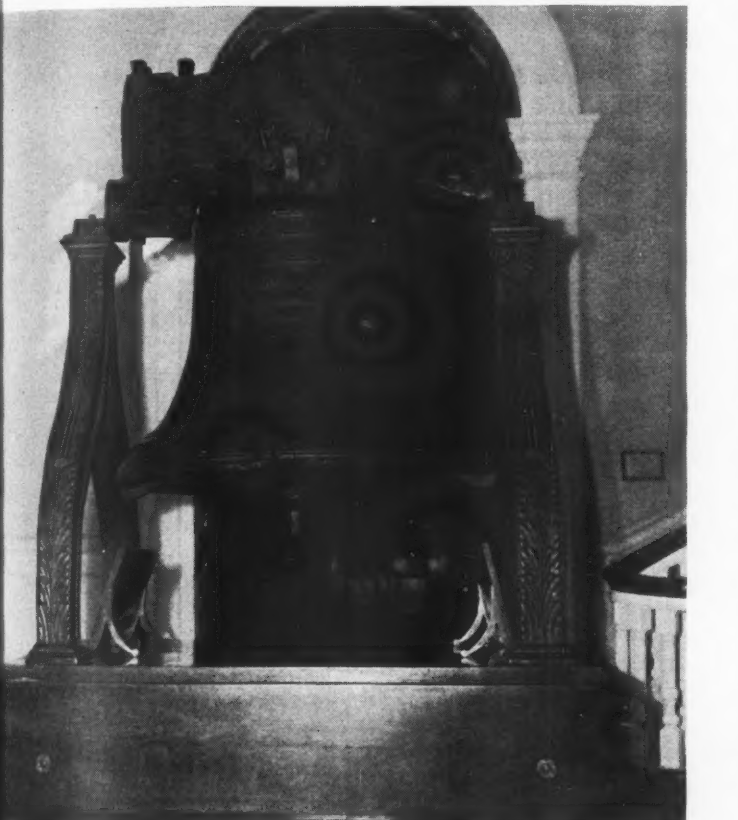
by the considerable attendance from abroad at the past two Conventions. With an Exhibit next year in a city located close to the Atlantic Seaboard, and therefore more accessible from Europe, the number of foundrymen who will come from the Continent may equal or exceed the 125 foreign visitors in 1946. The 1948 Annual Meeting will not be classed as an International Foundry Congress, since such an event is scheduled for Czechoslovakia in 1948 and there may be one held in the United States in 1952.

There is much evidence to indicate that the technical programs at A.F.A. Conventions have earned greater interest of foundrymen through improved quality of papers and sessions planned for maximum floor discussion. At the 1947 Annual Meeting in Detroit, for example, new attendance records were set and practically every meeting enjoyed capacity or over-capacity attendance. Greater interest in foundry techniques and processes is showing itself not only in the National Convention, but also in the demand for constantly improved programs at A.F.A. Chapter meetings.

Chapter Cooperation

The invitation of the Philadelphia Chapter, unanimously supported by the Chapter's executive committee on Novebmer 15, 1946, has been further supported by the Hotel Association of Philadelphia and the Philadelphia Convention and Visitors' Bureau. At the time of the invitation B. A. Miller, Cramp Brass & Iron Foundries Div. of Baldwin Locomotive Works, Eddystone, Pa., was Chapter Chairman. The new Chairman who will head the convention committees of the "Host Chapter" in 1948 is E. C. Troy, Dodge Steel Co.

Philadelphia Art Museum on Benjamin Franklin Parkway at 26th Street. Many pleasant hours can be spent here looking at beautiful portraits and statuary.

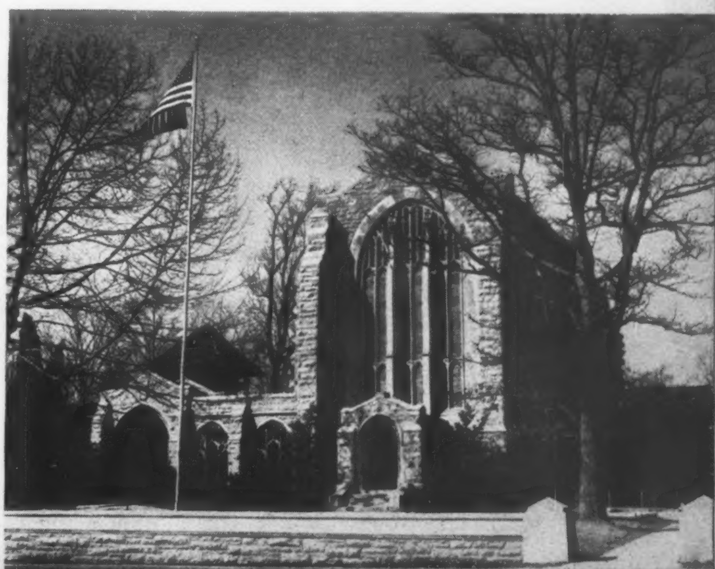


Probably the most famous symbol in the history of the United States and surely one that is immediately thought of in relation to Philadelphia—the Liberty Bell in Independence Hall.

The Association has been assured by the Philadelphia Hotel and Convention groups of hotel accommodations adequate for a Conventional Exhibit of the size expected in 1948. As in recent years, and to provide the most equitable distribution of accommodations, all advance hotel reservations will be handled through an official A.F.A. Housing Bureau with headquarters at the Philadelphia Convention and Visitors' Bureau, of which Charles L. Todd is Executive Director. Hotel application blanks will be distributed to members and exhibitors later in the current year and should be adequate for housing all exhibitors and A.F.A. members who request reservations.

In addition to the Convention sessions and the Exhibits, many opportunities will be presented for visiting important foundries in the Philadelphia area. The area in and around Philadelphia is rich in historic interest, adding further inducement for attendance by members and their wives.

Memorial Chapel built at Valley Forge. This is the historic site where Gen. George Washington established quarters for his Revolutionary forces.



ANNUAL CHAPTER CHAIRMAN CONFERENCE . . .

FORTY-FOUR A.F.A. CHAPTER officers and directors gathered in the Palmer House, Chicago, June 30-July 1-2, for the Fourth Annual Chapter Chairman Conference. As has been the case since 1944, when the conference was first instituted, the event proved a pronounced success, and a number of chapter chairmen termed the conference "the best ever held by the Association."

A.F.A. Vice-President-elect W. B. Wallis, president, Pittsburgh Lectromelt Furnace Corp., Pittsburgh, presided as chairman of the meeting. Other national officers who attended were:

President S. V. Wood, president, Minneapolis Electric Steel Castings Co., Minneapolis.

Vice-President Max Kuniansky, vice-president and general manager, Lynchburg Foundry Co., Lynchburg, Va.

Director Jas. H. Smith, general manager, Central Foundry Div., General Motors Corp., Saginaw, Mich.

Director G. K. Dreher, executive director, Foundry Educational Foundation, Cleveland, and guest speaker at the conference luncheon July 1.

Director S. C. Wasson, manager, National Malleable & Steel Castings Co., Cicero, Ill.

Director B. L. Simpson, president, National Engineering Co., Chicago.

Guests included: E. A. McFaul, head, Department of Speech, DePaul University, Chicago, guest speaker at the conference dinner June 30; H. F. W. Hauslein, Harold Hauslein & Associates, Engineers, Chicago, conference speaker on the morning July 2; G. N. Sieger, president and general manager, S.M.S. Corporation, Detroit, guest speaker at the conference luncheon July 2, W. H. Gude, managing editor, *The Foundry*, Cleveland, and R. E. Kennedy, University of Illinois, Navy Pier Branch, Chicago.

Thirty-six active A.F.A. chapters were represented at this meeting. The three-day session was called for the purpose of discussing closer relations between the national and local activities, so as to coordinate activities of the national association. Eight chapters (Canton District, Detroit, Northern Illinois-Southern Wisconsin, Saginaw Valley, Mexico City, northeastern Ohio, Western New York, and St. Louis District) sent additional delegates to benefit from the discussions that occurred at this meeting.

Chapter officers who attended were:

Birmingham—Chairman W. E. Jones, chief engineer, Stockham Pipe Fittings Co., Birmingham, Ala.

★ *The principal speaker at the Chapter Chairman Conference Banquet held Monday evening, June 30 was E. A. McFaul, De Paul University, Chicago, center, speakers' table.* ★

JUNE 30 • JULY 1 & 2

British Columbia—Secretary-Treasurer L. P. Young, metallurgist, A-1 Iron & Steel Foundry, Ltd., Vancouver, B. C.

Canton—Chairman C. F. Bunting, foundry metallurgist, Pitcairn Co., Barberton, Ohio.

Vice-Chairman E. H. Taylor, plant engineer, F. E. Myers & Bros. Co., Ashland, Ohio.

Central Illinois—Chairman A. V. Martens, president, Pekin Foundry & Mfg. Co., Pekin.

Central Indiana—Chairman W. B. Ziegelmueller, vice-president and general manager, Electric Steel Castings Co., Indianapolis.

Central Michigan—Chairman D. J. Strong, president, Foundries Materials Co., Coldwater.

Central New York—Chairman R. A. Minnear, foundry superintendent, Ingersoll-Rand Co., Painted Post.

Central Ohio—Vice-Chairman F. W. Fuller, field engineer, National Engineering Co., Westerville.

Chesapeake—Chairman W. H. Holtz, superintendent, American Brake Shoe Co., Baltimore, Md.

Chicago—President F. B. Skeates, foundry superintendent, Link-Belt Co., Chicago.

Cincinnati—Chairman E. A. Kihn, general foreman, Cincinnati Milling Machine Co., Cincinnati.

Detroit—Chairman W. W. Bowring, sales engineer, Frederic B. Stevens, Inc., Detroit.

Vice-Chairman A. W. Stolzenburg, products and process engineer, Aluminum Co. of America, Detroit.

Eastern Canada and Newfoundland—Chairman O. L. Voisard, general superintendent, The Robert Mitchell Co., Ltd., Montreal, Que.

Metropolitan—Chairman K. A. De Longe, Development and Research Div., International Nickel Co., New York.

Mexico City—President, Manuel Goicochea, general manager, Fundiciones de Hierro y Acero, S.A., Mexico City.

Secretary-Treasurer N. S. Covacevich, Owner, Casa Covacevich, Mexico City, D.F.

Michiana—Chairman H. B. Voorhees, foundry superintendent, Peru Foundry Co., Peru, Ind.

Northeastern Ohio—President, H. C. Gollmar, general manager, Elyria Foundry, Elyria.

Vice-President E. C. Zirzow, core room foreman, National Malleable & Steel Castings Co., Cleveland.

Northern California—President A. M. Ondreyco, plant manager, Vulcan Foundry Co., Oakland.

Northern Illinois-Southern Wisconsin—Chairman John Clausen, foundry engineer, Greenlee Bros. & Co., Rockford, Ill.

(*Concluded on Page 83*)

Far West representatives, including two from Mexico, who attended the Fourth Annual Chapter Chairman Conference. Top row (left to right) Tri-State Chairman R. W. Trimble, Oregon Chairman A. R. Prier, British Columbia Secretary-Treasurer L. P. Young, and Washington Chairman C. M. Anderson. Bottom row (left to right) Mexico City President Manuel Goicochea, Southern California President H. E. Russill, Mexico City Secretary-Treasurer N. S. Covacevich, and Northern California President A. M. Ondreyco.

Left to right—Eastern Canada & Newfoundland Chapter Chairman O. L. Voisard, Robert Mitchell Co., Ltd., Montreal, Que.; British Columbia Chapter Secretary-Treasurer L. P. Young, A-1 Iron & Steel Foundry, Ltd., Vancouver, B.C.; and Ontario Chapter Chairman James Dalby, Wilson Brass & Aluminum Foundries.

MAKING PLASTIC PATTERNS

E. J. McAfee
Master Patternmaker
Puget Sound Naval Shipyard
Bremerton, Wash.

It is perhaps too early to say how greatly plastics will affect the metal industries. Even the most enthusiastic plastic advocate must acknowledge limitations in the use of these materials, especially in the extent to which they may or may not displace metal castings. It is inevitable that any transition of industry from the basic to plastic will require new or changed techniques in the manufacture and fabrication of many products. This conversion may displace some skills and others will be assimilated into the new methods.

In manufacturing lines, plastic materials are generally pressed in dies or cast in molds by methods with which the metal industries are intimately familiar. In fact, the plastic industry has adopted much of the terminology of the metal trades as well as those methods of molding and fabrication that are applicable.

Progress in industry necessitates the constant search for better and more economical methods, as well as materials for their produce. Motivated by this thought, early in 1942 we undertook a search among the plastics for better pattern material, which resulted in selection of the thermosetting phenolic casting resin as the most suitable material for future experiments.

The reasons for the selection of this type were:

1. It could be cast in easily produced molds of inexpensive material.

2. In the initial experiments this material was found superior to wood, metal or plaster patterns for either machine or hand molding, as it requires less

Spraying a wood pattern with a low-melting-point eutectic alloy in order to produce a mold in which a phenolic resin reproduction may be cast.

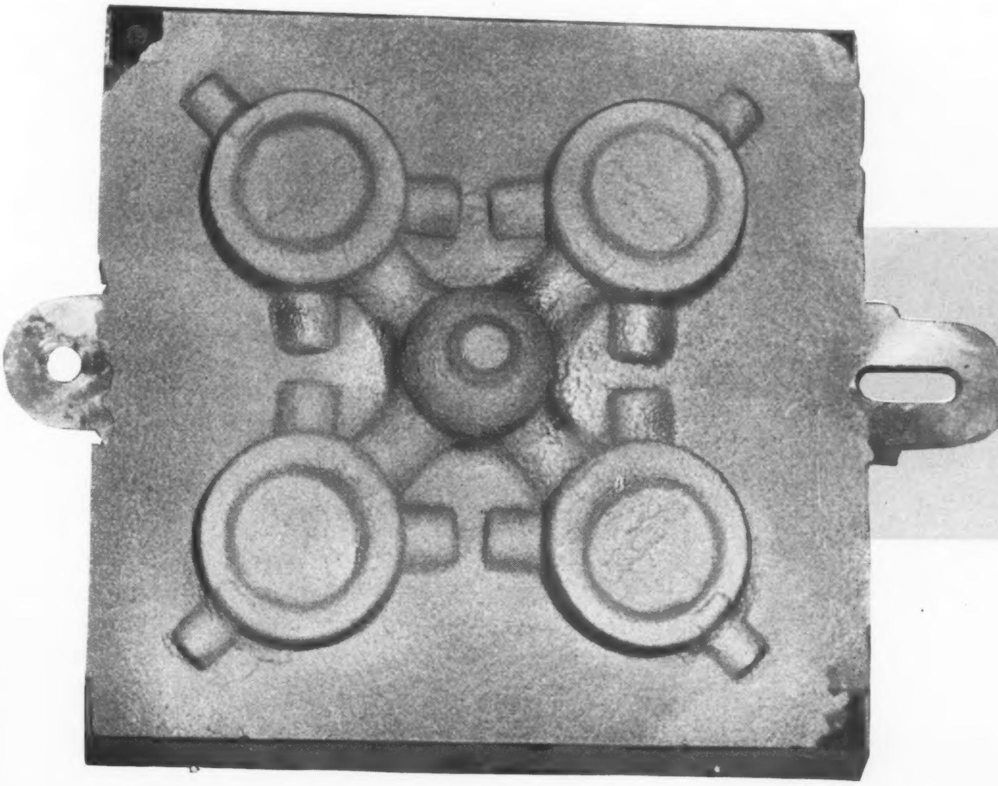
rapping or vibration to be withdrawn from the mold. It does not require the use of parting agents to free it from the sand. In fact, it performs better without a parting agent and requires but little care, the only preparation necessary between each ramming being a blast from the air hose to clear the pattern of the fines from the sand. The plastic seemingly has a natural attraction for them, which in turn means a cleaner mold.

3. The plastic needs no protective coating against moisture absorption or as a filler for surface pores, as it has a porcelain-like finish and is non-absorbent. Patterns may be left in the sand as long as necessary without ill effects. The curing cycle, after the initial cure, continues over a long period, after the pattern is actually in use, resulting in continual hardening of the surface and darkening in color.

Synthetic resins cover a wide range in the field of plastics and, to the present, we have found only a few that are adaptable to foundry pattern applications. As to time and cost, it has heretofore been impossible to produce patterns and core boxes of these materials in competition with the conventional materials of wood or plaster when only few molds are desired; however, plastics can successfully compete in the field where duplicate patterns are necessary, such as match plates or follow boards for machine molding, when quantity production is desired, or to duplicate and repair an intricate pattern that is broken or worn out. It also has an additional advantage through its adapatability to foundry practice and usage.

Methods of producing plastic patterns are much the same as those followed for metal patterns. The pattern is cast from a mold made from a master pattern and then manufactured into the finished product. Little or no cleaning, filing, sanding or buffing is necessary. The plastics can be successfully cast without pressure. The resulting product is dimensionally stable, has a compressive strength of 12,000 to 15,000 psi, and low coefficient of shrinkage after casting. The minimum shrinkage is 0.0025 in. per in. when using 8 per cent catalyst with a curing period of 8 hr, to a maximum of 0.0047 in. per in. when using 4 per cent catalyst with 2 weeks' cure at 140 F. Time and material are also saved, as it is unnecessary and undesirable to apply protective coatings such as shellac or synthetic lacquers to the pattern surface.

The practice by the molders of dusting the pattern between the ramming of each mold with a parting agent is superfluous and, in fact, should not be allowed. The only care needed is an occasional blast from the air hose to remove the sand fines. Production from one machine board is almost unlimited, the records showing ten and twelve thousand castings produced and the patterns still good for many more.



Sprayed mold as it appears before removal from the master pattern.

When manufacturing machine-board patterns or match plates, we have heretofore cast the plastic patterns in open molds and mounted them upon suitable plates of wood or metal, and have not attempted to cast the cope, drag and plate as a single unit of plastic, due to the low impact strength of the material. If the plate and pattern were made as an integral plastic unit, it would be necessary either to reinforce the plate section heavily or make it too thick to be practicable. It would create a waste of material and add to the weight. We have just developed a method whereby we can use plates of plywood, other plastics, or metal, and cast the phenolic patterns as an integral part thereof. These plates are given a coating of phenolic resin (by a method which will be discussed later), which gives them the advantages of plastic, retaining high impact strength.

It has been found through tests that plastic core boxes are superior to those of metal in withstanding the wear and abrasive action of the sand, even when used with a core blower.

The casting resins used in the production of foundry patterns are an example of a plastic which hardens into an insoluble mass after polymerization. Polymerization is a term commonly used to describe a chemical action whereby a substance is changed into a compound having the same elements but different physical properties than the original substance.

In the present instance, this has a reference to the transition from the liquid to the solid state which is brought about in the process of mixing and curing the resin in a suitable oven. The finished product is infusible under renewed heating, and is resistant to water and to most acids.

The liquid resins available for casting purposes generally contain all the elements required for polymerization. The principal ingredients of commercial blends are phenol and formaldehyde, or phenol and aldehyde. When these are blended, in the presence of a catalyst, a chemical action is set up resulting in polymerization.

As supplied by the manufacturers, the resins have about the consistency of thick honey. When a catalyst or accelerator is added to this compound, it promotes a chemical reaction which generates heat and the compound sets up much in the same manner as concrete or plaster-of-paris. Phenol (carbolic acid) is a by-product of coal; formaldehyde is derived from synthetic alcohol, and aldehyde is derived from vegetable products. The accelerator may be a soda and acid solution which contributes no true element to the ultimate product but, as the name implies, it accelerates polymerization.

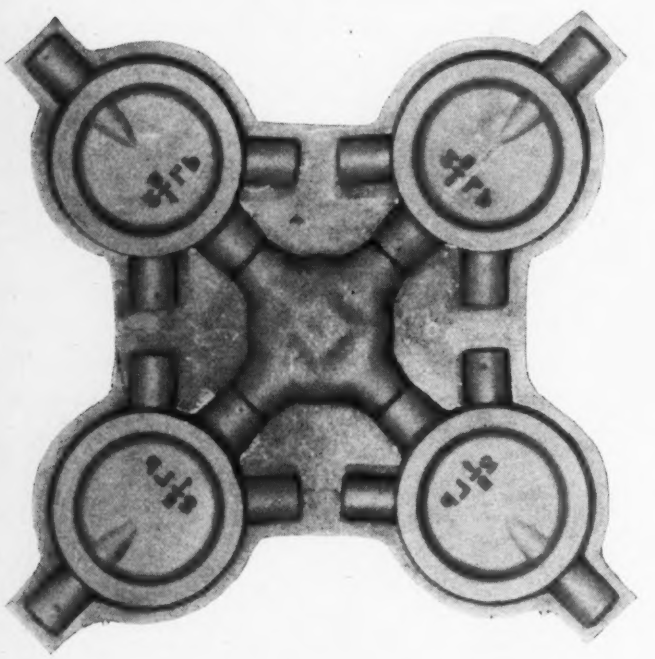
The curing cycle begins as soon as the solution is poured, and it may be said that it is divided into two periods which vary with conditions. Light castings are allowed to stand about 4 hr; they are then baked for 4 hr at 140 F controlled heat. Heavier castings stand proportionately longer, and may be baked for 8 hr or more as required.

Plastic Casting Techniques

Before discussing the production details of a plastic pattern, it may be well to give a brief summary of the procedure involved:

1. A mold into which the phenolic resin is to be poured is made from the original or master pattern, either of plaster-of-paris or other suitable material that will withstand 140 F oven temperature.

2. The surfaces of the mold which will contact the liquid resins must have a smooth finish and be given a



Left—Mold for 2½-in. valve disc pattern after removal from master pattern and trimmed of excess material. Below—Valve disc pattern molds after being placed in cope and drag and prepared for casting with resin.

Preliminary pouring of drag half of the mold.

protective coating which can be combined with and also used as a parting agent, in order to protect the mold walls from the chemical action caused by the polymerization of the plastic during oven curing.

3. The liquid resins are prepared by mixing with a phosphorus acid solution containing aluminum and calcium salts, called the accelerator (or catalyst), to promote polymerization.

4. A curing process, accelerated by oven baking in a dry heat at comparatively low temperatures, results in the solidification of the liquid resins.

The mold in which the resin is to be cast may be made by using the original as a pattern, if it is not so large that the additional shinkage of the resin will materially affect the finished dimensions desired, or from a master pattern made to take care of all shrinkages. The material used for the mold may be of wood, plaster-of-paris, rubber latex, synthetic rubber, or from a low melting point bismuth-lead alloy that will withstand the curing temperature of 140 F. In the present case the mold material used was a bismuth-lead alloy composed of 50 per cent bismuth, 26.8 per cent lead, 13.2 per cent tin and 10 per cent cadmium, and with a melting point of 158 F.

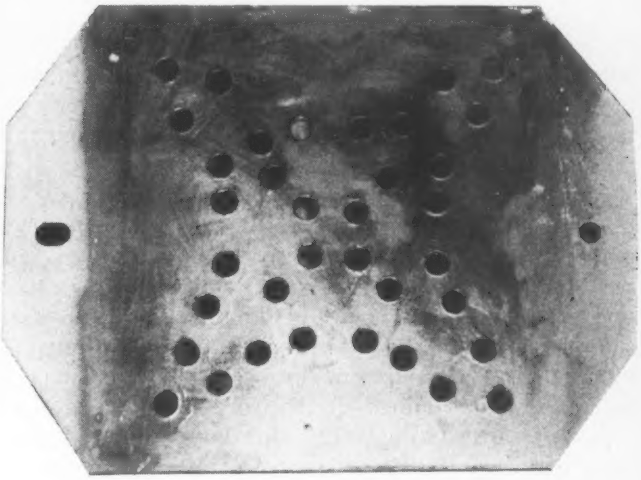
Match Plate Pattern

The accompanying illustrations show the various operations necessary to produce a 2½-in. gate valve disc pattern on a match plate. After placing the drag half of the master pattern on a flat surface, it was sprayed with a coating of a low melting point eutectic alloy about ⅛-in. thick to give the mold the proper rigidity. This alloy should have a melting point slightly higher than the curing temperature of the plastic resin, which is 140 F. The spraying was accomplished with a paint spray machine with a nozzle temperature of 200 F; in fact, the ideal condition is to have the entire machine at this temperature, including the container holding the liquid metal. After the mold cools to room temperature, it may be removed from the pattern and placed in the desired position in the flask, and held in place by ramming sand behind it or anchoring with a backing of molding plaster.

The master pattern is then replaced in the mold, the cope half pattern put in place and given the same spray treatment as the drag.

After coating the mold with a parting agent of plastic paint and applying a thin coat of a high-melt wax, the match plate is placed between the cope and drag flask. It is then ready for casting the phenolic resins. During the foregoing process, the necessary gates and risers are provided for in the same manner.

Casting the phenolic resins in open molds affords no



Match plate prepared for casting integrally with cope and drag halves of mold to produce plastic pattern.

serious problems, but casting them in the closed molds just described has presented some problems, such as air pockets due to the high viscosity of the liquid resins during the pouring periods. Care must be exercised to properly vent the mold. It is hoped that experiments now under way will solve this problem and simplify the process.

The mold from the corebox is made with a wooden or plaster replica of the core placed in a frame. After a primer coat of shellac it is given one or two coats of acid-resistant paint, brushed on, and after thorough oven drying is coated with wax cut with gasoline. The mold then is ready for casting the plastic.

When molds are made of plaster and are thoroughly dry, they are subjected to a surface treatment calculated to make the finish smooth and impervious to the chemical action of the resins and the heat of the oven.

The wall thickness of these molds should be made as thin as possible, since the drying and baking time of the resin is governed by the amount and type of the mold material that the heat must penetrate.

All mold surfaces that come in contact with the casting resins should be well smoothed and finished with a

Final pour, with cope, drag and plate clamped together.

suitable parting agent. This is particularly important when a number of patterns are required from one mold, as it is difficult to withdraw the plastic pattern without breaking the plaster mold, even under the most favorable conditions.

Porous materials such as plaster and wood may be prepared by giving them a sealing coat of shellac, bayberry wax or clear lacquer followed by a light coat of petroleum jelly. Lacquer is a commonly used material, several coats of which should be applied and sanded smooth. Good results have been obtained by using one of the following parting mediums over lacquer or shellac. They are named in the order of preference: (1) aluminum laurate, (2) zinc laurate, (3) aluminum stearate, (4) zinc stearate. It must be borne in mind that these parting materials are suggested in the absence of specific instructions from the manufacturer.

Another good parting method consists of a prime coat of shellac (thin enough to avoid heat blisters), sandpapered lightly and followed with a heavy coat of an acid-resistant plastic paint that peels off in a layer after the casting is cured. When the paint has dried a final coat of floor wax may be applied and polished with a soft cloth to give a smooth finish. Common beeswax diluted with gasoline has been found superior to many commercial products, which usually contain some water and produce steam in the heat of baking, resulting in displacement of the still soft plastic or blow holes in the plastic pattern.

Blending and Mixing Phenolic Resins

The following description applies in general to phenolic casting resins marketed under various trade names. Since these products are not identical, the manufacturers' directions should be observed for best results. These products are known as thermosetting resins, the term indicating that the plastic sets with heat, whether self-generated or applied. These materials are thereafter infusible and do not soften under further heating.

As supplied by the manufacturer, the casting resin is blended in proper proportions except for the additional catalyst and fillers that may be required. No attention will be given to fillers at this time, since their principal object is to reduce the cost of large casts, and it has been learned that they reduce the strength and wearing qualities of the product.

The catalyst generally is supplied by the resin manufacturer and should be carefully measured and mixed as directed. The purpose of the catalyst is to accelerate polymerization. This is the chemical action that changes the nature of the resin from liquid to solid. As soon as this mix has been made, polymerization begins. Heat advances this chemical action and cold retards it.

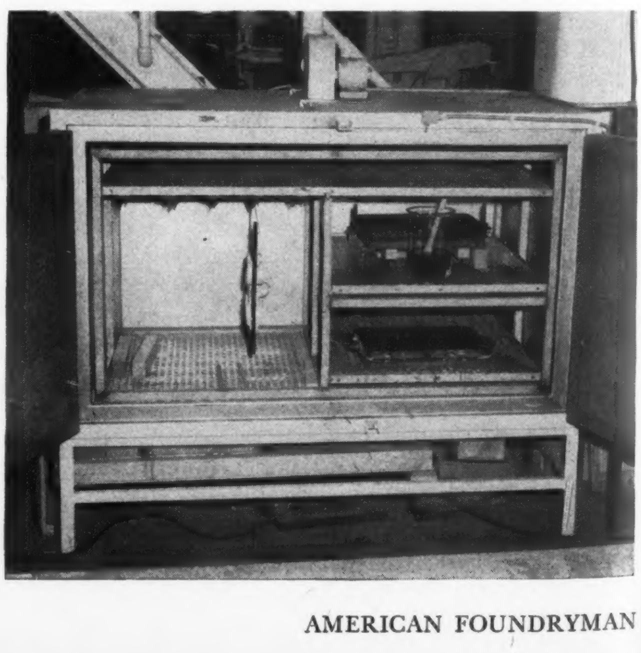
The accelerator should be added slowly and stirred carefully to avoid air bubbles. Too much accelerator in a localized spot may cause frothing of the mixture. To prevent excessive air bubbles, it is advisable to use a beater continuously submerged in the solution. A hardwood dowel pin with a cross bar on the end can be used in a hand brace or in a mechanical mixer at slow speed. It should be stirred until all ingredients are thoroughly blended. The mix generally will change color during this process, and the completeness of the blend is indicated by a uniform color. Streaks or spotted color indicate an imperfect mix.

In order to permit air bubbles to escape, the mix should stand in the container for a short time before it is poured into the mold. During this time, which should be not less than 15 min nor more than 2 hr, the surface should be skimmed occasionally to break the film which otherwise would restrict the air bubbles.

Pouring Method

As a rule, the resin is poured into the mold about 15 to 30 min after mixing. The pouring should be confined to a small area and should be done slowly to avoid trapped air pockets or bubbles. These bubbles generally rise to the surface of the casting, resulting in open pores or pits which disfigure the surface. When a smooth surface is required, it is advisable to allow ex-

View of oven containing cope and drag mold being preheated before casting; a completed pattern during final cure; and a jar of phenolic resin being preheated prior to pouring a mold.



cess material, which is later removed by machining. A wooden frame about 1/4 to 1/2-in. thick provides the necessary container for this upset or riser.

After the resins have been poured into the mold, they are allowed to set at room temperature for several hours before being baked in the oven. Castings should be allowed to stand until they become opaque and then baked until hard. The time element cannot be accurately stated because it depends upon the volume of resin, the amount of catalyst and the heat insulating characteristics of the mold.

The baking temperature is important and should be closely checked. The time of standing at room temperature or the time of the bake do not appear to be so important. A 4-hr set and an 8-hr bake will satisfy ordinary conditions. If the casting is soft and pliable after removal from the oven, it should be returned for further curing. The curing temperature should range from 138 to 142 F.

The completed pattern may be given a coating of the casting resin by cutting it with a 50 per cent solution of either ethyl or butyl alcohol, and applying with a brush. As many coats as desired may be applied, but they must be oven cured for a minimum of 4 hr.

Heating Equipment

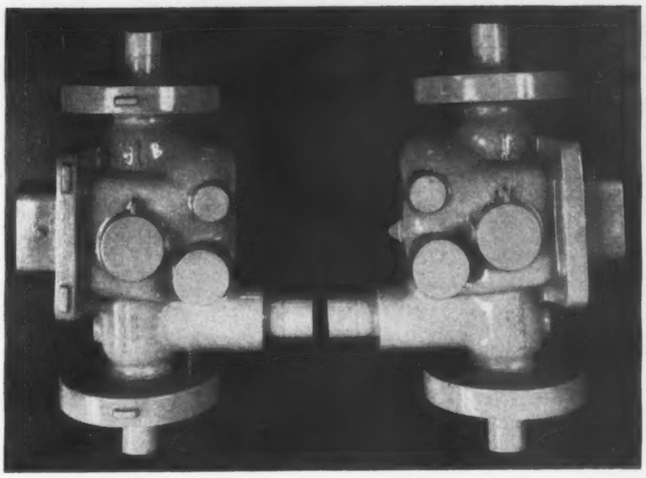
Heat control is an important factor to be considered. However, it is not necessary that the equipment be elaborate or expensive. Since the baking temperature is less than the boiling point of water, it is possible to make a plain oven of wood, lined with a sheet of asbestos for insulation. This type of oven, heated with electric light bulbs and controlled with a brooder thermostat was successfully used to demonstrate the simplicity of the procedure.

Smaller pieces were baked under an electric light reflector by the simple expedient of regulating the heat by adjusting the distance betwetn the reflector and the mold. These methods are not recommended for practical use, but are mentioned to show that the lack of special equipment need not deter the patternmaker who is interested in experimenting in this field.

Electric and gas ovens are obtainable for professional use. A type that has an air-circulating and exhaust system to remove moisture and gasses is preferable for plaster and plastic work. In the dehydration of plasters, the moisture should be exhausted from the drying area to avoid an insulating strata of steam about the mold that retards the drying rate and tends to chalking or crumbling of the material and the consequent danger of cracking. Air circulation is desirable to avoid danger to the plastics from heat concentration.

Ovens can be obtained with controlled heat adjustments of from 100 to 600 F. It is desirable that the temperature range be controlled within reasonably close tolerances, especially in the lower heat ranges, between 140 and 350 F, at which most plastics are treated.

Phenolic casting resins, in the liquid state, will deteriorate quite rapidly unless properly stored. They should be kept in a closed container at a temperature lower than 50 F, and will keep indefinitely at this temperature. They are highly reactive at temperatures of 70 F and above. Should the resins, through improper storage, become too heavy for use, they may be thinned for pouring by heating to 140 F. The mold as well as the resin should be heated, and the accelerator added and mixed just before pouring. The resin should always be brought to room temperature before the mix is made. Some manufacturers recommend heating of their products to the maximum curing temperature.



Cope and drag halves of test casting made of phenolic resin. This plastic pattern was used in hand molding.

Molds may be of wood, plaster or acid-resistant metals such as lead. Metals that are not acid proof should be coated with a special varnish furnished by the plastic manufacturer. Plastic molds for plastic patterns can be used if a good parting surface is prepared in order that contact will not be made with the new mix. Pigmented lacquers of different colors are used to assure full coverage by color contrast.

If repairing, patching or cementing of the plastic is required, use the liquid resin with 15 per cent accelerator as an adhesive. Local or oven heat may be used to cure the patch. Sections of patterns, rods or blocks may be cast, machined and cemented to build up patterns, core boxes or even jigs by this method.

Making Metal Inserts

Sometimes it may be found necessary to make inserts of metal after a plastic cast is made. Low-melting-point alloys can be used to anchor these insertions firmly in place. Another suggestion is to drill tight holes for bushings, then chill the metal and tap it carefully into position. When the metal warms to room temperature and expands, it will grip the plastic tightly.

The plastic can also be drilled and tapped easily for dowels or pins, as well as machined to close tolerances. When the plastic pattern or cast must be made to close tolerances, it will be necessary to make suitable shrinkage allowances on the original pattern. For small jobs the shrinkage is often negligible, $\frac{1}{32}$-in. shrinkage per ft being allowable when conditions permit. If tolerances are highly critical, however, it is necessary to consider mold expansion at oven temperatures and an after-shrinkage of the plastic following the curing and cooling process.

NOTE: Opinions and statements expressed in this paper are the author's and are not to be construed as necessarily reflecting those of the Navy Department.

PRESIDENT'S ADDRESS

S. V. Wood

SUMMARIZES A. F. A. PROGRESS

On this, the occasion of the 51st Annual Convention of the A.F.A., and the first year of the second one-half century of its existence, I find myself confronted with the task, by custom long since established and an accepted obligation of your Executive Officer, of presenting the President's Annual Address.

With the knowledge that it was incumbent upon me to continue this custom, which has now become a tradition, I have recently reviewed the addresses of former presidents. I can assure you that it has indeed been pleasurable reading and has brought back to me memories of friends and acquaintances within this organization, memories which I cherish and friends whose advice and counsel I value most highly and for which I am most grateful.

Good Association Officers

This Association has been blessed with fine officers down through the years, and the fact that it has a long and unbroken history of successful service speaks well for the serious and unselfish efforts of these men.

In many of these past addresses I find the words: "This is a critical period." These words were not spoken because of fear for the future, but because these men were serious minded about their task, were anxious about their ability to successfully carry on in the service of their industry.

A review of the volumes of the A.F.A. Transactions, impresses one with a realization that casting practices, techniques, and procedures are continually changing. It impresses one also that the basic concept, the general objectives of the American Foundrymen's Association have changed but little. The original by-laws set forth that the objectives of the new Association will be, namely, "To promote the arts and sciences applicable to metal castings manufacture, and to improve the methods of production and quality of castings."

Human endeavor cannot long survive in an association of men unless founded upon sound objectives and a burning desire to accomplish. Who is there that would care to challenge the statement that within these words from the early by-laws are set forth today's concept of our obligations. Within these areas we have operated successfully for fifty years, and within these areas we still can operate and yet broaden our activities.

That this Association is fortified with worthy objectives and sincerity of purpose is reflected in an ever expanding membership roll. As of April 1, 1946, membership totaled 8073, while the report of April 1, 1947, shows a total of 9364, an increase of 1291 members, and increasing recently at a rate of 200 new members per month. It is, therefore, fair to presume that the total should, on July 1 at the close of our fiscal year, be very close to 10,000 members.

This is a marvelous growth, particularly for a postwar period when adjustments of personnel are always particularly heavy. It is especially significant when one realizes that there has not been a campaign for new members; instead, interested men realize that this Association has much to offer, and desire to become a part of a living, moving group who have pride in their craft.

Increasing membership is a tribute to the continuing efforts of both chapter and national officers and directors and the national staff who constantly make available new foundry information, ideas and techniques. It also places upon these same workers the added responsibility of finding work for this increasing membership, for it must be borne in mind that this is a voluntary and cooperative organization.

National and Chapter Service

These opportunities for service are to be found at two levels—the National level and the Chapter level. At the National level we have over 110 committees with several hundred men as working members. At the Chapter level will be found hundreds of committees

and thousands of men at work in chapter activities. These committeemen are not appointed by the National office; they are selected men. Committees accept definite and distinct responsibilities; they have signed their names to the committee cards whereon they have pledged their willingness to serve.

Top men of the foundry industry from all over the world—engineers, metallurgists, supervisors, operating men and technicians—are voluntarily giving of their time and effort for the betterment of their industry.

No company is large enough to command and no company has sufficient funds to buy the services of these men, yet you, as a member of the American Foundrymen's Association, have the services of these men in their speaking assignments, in their committee program, in their writings and research.

A Live Organization

The A.F.A. is not an accident: it is a live, throbbing organization, established and built by men who have found, over the passing years, pride and profit in an industry that they love. This is pride of craft at work.

Now a word about the A.F.A. chapters, the home-town working units, of the Association. Close to 95 per cent of our members are affiliated with chapters. Each chapter is a completely organized working unit with officers, boards of directors, committees appointed and elected by chapter membership. The chapter boards and committees plan and carry out monthly meetings.

Within these groups is born the sparks of enthusiasm for the industry and are found and developed the men for future leadership of chapters. Herein are they trained and developed for future national officers.

These men are being trained and developed for association work, but they are also being trained for leadership in your plants and companies. Here you will find men of all levels—engineers, technicians, metallurgists, supervisors and salesmen all imbued with the idea of improving themselves and their industry.

At the beginning of this 51st year there were 33 of these chapters, and now, at the time of your Annual Meeting, there are 38 chapters. Five chapters have been organized this year:

Washington chapter, Seattle, No. 34
Rocky Mountain Empire chapter, Denver, No. 35
Tri-State chapter, Tulsa, Okla. No. 36
British Columbia chapter, Vancouver, B.C. No. 37
Central Michigan chapter, Marshall, No. 38

June 30-July 1-2, of this year, at Chicago, the Fourth Annual Chapter Chairman Conference * where incoming Chapter Chairmen and Vice-Chairmen will meet in a three-day conference to discuss and study the work of the Association and their chapters.

To this meeting will come the chosen leaders of your chapter, gray iron men, steel men, brass men, malleable men, pattern men, and supply and equipment men, all vitally interested in the production of castings, all to learn of the other fellow's problems. Also to learn of the importance of the casting industry; its history; to dream of its future; and to learn how to improve your industry, plant and products.

How I wish all of you men here today could be at this meeting to see how eagerly these men will approach the activities of this three-day conference. These meetings are serious business to these chapter officials. Starting at an early hour their discussions continue throughout the three-day session.

Even an onlooker would be dull if he did not feel aroused and heartily stimulated by the sincerity of these men and the new ideas that they develop from their discussions and instructions. These chapter chairman conferences are the great meetings of our Association. Here are made the acquaintances, the contacts, the friends—here are found the sources of information —here is developed the know-how of leaders. My only wish is that all of you could sit in and observe this new bubbling enthusiasm; it speaks well for the future of the American Foundrymen's Association.

Now that I have pointed out the highlights of this annual meeting where men from all divisions of the industry are gathered, may I say just a few words about another meeting which has been carried on this year.

This is a group consisting of two top elected executives of each branch or division of the industry, the presidents and vice-presidents of the Malleable Founders' Society, Gray Iron Founders' Society, Non-Ferrous Founders' Society, Steel Founders' Society, Foundry Supply Manufacturers' Association, Foundry Equipment Manufacturers' Association, National Founders' Association, and our own Association.

The elected officers of these long established associations have had several meetings this year, not formal but very intimate meetings where we are each learning definitely about each organization, its hopes, its plans, its objectives, its resources, and its manpower.

We are coming together as a beginning; we are working together for progress; and we are determined to keep together for success.

We are meeting informally under the organization name of the Castings Council, without permanent officers, without definite plans, and without a budget. But, with growing confidence in each other and with an increasing belief that from our efforts will come an over-all casting group which can tie together all groups interested in casting of metals, we are forging ahead.

Tie The Associations Together

We have met thus far without fanfare or publicity, but with open minds and sincerity of purpose. I am not only hopeful, but truly believe that eventually we will come forth with an organization that will tie together all of our individual associations and make it possible to do a better job for the entire industry.

It has been my privilege this year to personally visit a number of the A.F.A. chapters. I have, in company with your Executive Secretary or other staff members, traveled close to 50,000 miles, and have already visited fourteen foundry or chapter centers and expect to visit an additional number before the year closes on July 1. These visits have covered a wide area, from Seattle and Portland in the Northwest to San Francisco and Los Angeles along the Pacific shores, to Birmingham, Alabama, in the Southeast section, to Boston in the Northeast, to Toronto, Canada in the north, to Houston and

* See pp. 24-25 for report of conference.

Lufkin, Texas in the southwest corner of the nation.

At each of these points I have held from one to six meetings with management people, with officers and Boards of Directors, various chapter committees, and general meetings with the membership. In all I have attended 50 or 60 meetings, and in addition thereto have made innumerable calls upon foundrymen in their own plants and offices wherever I have gone.

In addition to these meetings which I have attended, A.F.A. Vice-President Kuniansky has met with additional chapters as have several other directors and some members of the staff.

Everywhere I have gone I have found a warm and enthusiastic welcome from members anxious to do their part in carrying on the work of the Association. It has been a glorious experience for me and I am proud indeed of the spirit of this great Association.

I have been impressed particularly by the feeling of unity among our members. There is a feeling of cordiality between supply and equipment people and the men in the plants, between technicians and operating men and, as for management men, I am gratified and thrilled with the attendance that we have had at the management luncheons. I hope and really believe that management in these centers where I have had the pleasure of visiting have a new conception of what the A.F.A. is doing for their men.

Chapter Interest Increasing

Everywhere I have gone I have had encouraging reports of increasing interest and activity in all chapter areas. Letters that have reached me since our visitations convince me beyond question that we are moving to an improved position among the industries.

I am convinced from my observations this year that the American Foundrymen's Association is soundly organized and functioning well; that it is fulfilling its accepted obligation as outlined in our by-laws; and is, first, "Properly promoting the arts and sciences applicable to metal castings manufacture," and second, "Improving the methods of production and the quality of castings."

We are in a fine position financially. The spirit and enthusiasm of the membership is high. We are fortunate in having a Board of Directors of outstanding quality, sincere of purpose and with a burning zeal to render unselfish service.

New Plans Being Made

The incoming officers and directors are outstanding men of long experience and leadership. Our staff at the National Office is of high quality, earnestly and harmoniously working for our welfare. Our new quarters at the Chicago office are a great improvement. We have many new things to do, plans are being made.

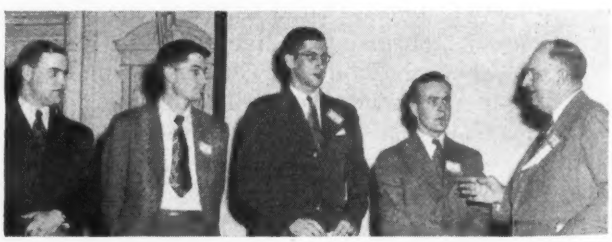
I am more convinced than ever, gentlemen, after almost a lifetime in the foundry industry, that "The FOUNDRY is a GOOD place to work" and, may I add with enthusiasm, it is getting better all the time.

In closing, may I take just a moment to express to my fellow officers and directors, to the committee chairmen and their committeemen, my sincere personal thanks and the gratitude of the membership for their cooperation and earnest help during this year.

And now, gentlemen, may I thank you all for your very great kindness to me and may I thank you, too, for the very great honor which you have given to me, the highest honor that can come to a foundrymen, and my earnest hope is that I have not served you in vain and that from my efforts and those of my fellow workers have come benefits which will bear fruit for the betterment of this great basic American industry.

Words of Wisdom

UTTERED BY A.F.A. President Wood at the Annual Business Meeting of the Association held in Detroit, April 30, were these words as he presented the cash prizes and award certificates to the four first place apprentice contest winners: "Gentlemen, it is a great honor and privilege to present you these award certificates and one hundred dollar bills which you so richly deserve. However, I wish to convey to each of you that it is not so much the monetary value of this contest that is important, rather it is the pride of accomplishment. As President of the American Foundrymen's Association I want to tell you that we are proud of you and happy to bestow upon you these awards. We hope that the knowledge, initiative and perseverance you have shown by way of this contest will be further reflected through your increased enthusiasm for the foundry industry. Many of the men sitting in this room today have spent their lives in the castings industry. If they have regretted being a part of one of the basic industries, they have not revealed it, and so I am sure that you four young men are embarking upon the right road. I assure you, as well as all the participants in this nation-wide competition who did such a grand job, that you are not wrong in choosing the foundry industry because the foundry is a good place to work."



(Left to right) Harold Gobeille, F. G. Matthews, John Hronek and William Waddicor, Jr., first place apprentice winners listen attentively to President Wood's words which are published here.

FOUNDRY SAND RECLAMATION

A report on the first phase of an extensive foundry research program sponsored by the British Columbia Research Council in the interests of the foundry industry of the Province. Presented at the Joint Western Conference of ASM and CIMM, November, 1946.

J. M. Cummings
and
W. M. Armstrong

British Columbia Research Council
Vancouver, Canada

IMPORTANCE OF CONTROLLED SAND PROPERTIES to the production of quality castings has been recognized by foundry men for many years, but the maintenance of requisite standards results in a relatively high sand consumption, which in steel foundries, for instance, may range from one-half to over one ton of sand per ton of finished casting. During the war, obtaining and maintaining adequate sand supplies became a serious problem in many foundries, owing to increased wartime production and transportation difficulties. As a result, considerable interest was aroused in the possibilities of various sand reclamation systems by which up to 85 to 90 per cent of discarded sand may be returned to a usable condition. During the past five years, a number of sand recovery installations have been made by both ferrous and non-ferrous foundries in Canada and the United States, resulting in substantial sand cost reductions in every case.

The possible benefits of sand reclamation are particularly apparent in British Columbia where no suitable sands for steel and heavy iron foundries occur naturally, and where freight costs on imported sands are considerably higher than initial selling prices. This is well illustrated by the fact that silica sand, which sells for about $2.00 per ton at pits in Illinois, is laid down in British Columbia for $11.00 or $12.00 per ton.

The operating costs quoted for certain of the reclamation schemes (i.e. $0.25 to $1.50 per ton) may actually be no higher than the cost of waste sand disposal in city-located foundries.

Steel Molding Sands

In view of the foregoing consideration, the British Columbia Research Council has undertaken a study of the possibilities for sand reclamation, with particular attention directed to its application in local steel foundries. No commercial occurrences of silica sand are known in the Province and, with this in view, the council previously investigated the possibility of recovering silica sand from local impure sands. Results were definitely encouraging, but it was felt that the present market is too small to permit economical production by the method developed.

Silica sand is used almost exclusively as a base material for cores and molds in the steel foundry, as it is the only relatively economical material of suitable physical properties which will not fuse or decompose at the temperature of molten steel. For making cores the sand normally is mixed with core oils and cereal binders, and for molds it is mixed with bentonite or refractory clays. In the latter case, cereal or organic binders, as well as silica flour, may also be added.

For steel casting purposes it usually is required that the sand contain over 95 per cent silica, be carefully graded as to grain size, and meet certain specifications as to permeability, green strength, hot strength, sintering temperature and durability. Steel foundries in British Columbia obtain practically all of their sand from producers in the vicinity of Ottawa, Ill., where the St. Peter's formation yields a product composed almost entirely of rounded quartz grains with 2 to 3 per cent clay. After washing, the sand analysis is about

Fig. 1—Diagram of sand reclamation test methods used.

Rate of feed reject sand, lb/hr	250
Pulp density in pebble mill, per cent solids	65
Pulp density classifier or table feed, per cent solids	35
Recovery washed sand—table, per cent	84
Recovery washed sand—classifier, per cent	86
Caustic soda added, lb/ton of feed	1

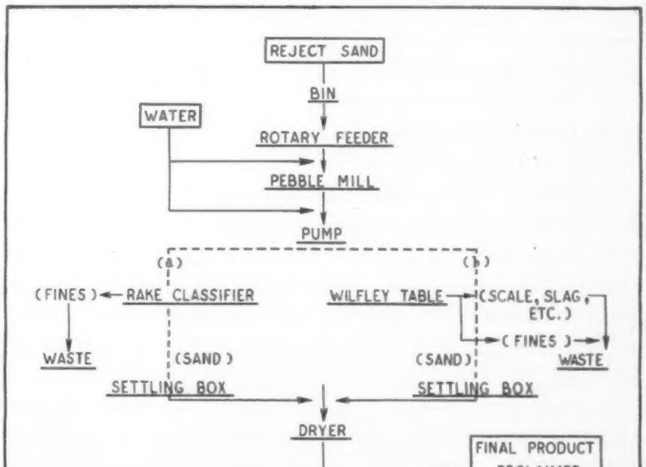


Fig. 2 (left to right)—Original discarded sand; sand after classification; sand after calcination.

99.5 per cent silica, and is marketed in several grades with different A.F.A. fineness numbers.

After use, the grains of core sand become coated with carbonaceous material as a result of baking and partial combustion of organic constituents. Grains of molding sand are coated with baked clay and varying amounts of carbonaceous material, and are mixed with silica, fine clay, and organic material. In general, sand is re-used to the point where its permeability and refractoriness are seriously reduced by the aforementioned impurities, after which it is rejected. Ordinarily, the core and molding sands become mixed at the shakeout, so that the final discarded product contains a heterogeneous mixture consisting of quartz grains of all sizes down to "flour," carbonaceous material, baked clay, slag particles and tramp metal.

The object of reclamation processes is to eliminate the various undesirable impurities previously mentioned, leaving a more or less clean sand product which may be re-used rather than discarded.

Reclamation Methods

There are several methods, or combinations of methods, used to treat spent sand. These may be discussed under the following general headings:

1. Dry Reclamation.
2. Thermal Reclamation.
3. Wet Reclamation.

1. Dry Reclamation

So-called "dry reclamation" processes have been used for many years, but serve primarily to open up tight sand and not to recover a product which can be substituted for new sand. In general, the method used is to break lumps and pass the sand through screens, after which some of the fines are removed in a column of moving air.

No attempt is made to eliminate clay and organic coatings from sand grains, and high losses of fine sand usually result from lack of selectivity in the classifying system. Choice of more precise air classifying equipment would minimize the latter fault, but even so, the final product would be unsuitable as a substitute for new sand unless means of removing adherent grain coatings were adopted. The usual "dry reclamation" system functions primarily as a reconditioning unit to prolong the life of molding sand, and performs a useful function as such.

2. Thermal Reclamation

The thermal reclamation process relies upon the use of heat in an oxidizing atmosphere to remove carbonaceous material from sand grains. For recovery of core sand, where organic binders are used almost exclusively, this method has proved highly satisfactory, but it has not proved suitable for treatment of molding or core sands in which clay binders are incorporated in any appreciable amounts.

Thermal reclamation systems have been installed in a number of light metal foundries, and are yielding recoveries of as high as 90 to 95 per cent from core sands which formerly were wasted. The method of treatment is basically the same in all cases, and comprises the following essential steps:

(a) Breaking of cores, screening, and removal of iron chills, wires, and arbors.

(b) Elimination of carbonaceous material in either a rotary or multiple hearth furnace at temperatures of 1200 to 1500 F in an oxidizing atmosphere. A large proportion of undesirable fines may be removed by controlled draft during this step.

(c) Cooling of sand in a suitable unit in which some of the fines may be further eliminated by draft control.

In one commercial installation, some degree of dry scrubbing is given the sand in an air-swept mill after roasting. Present installations are largely restricted to relatively large foundries handling from 40 to 300 tons of sand per day. Initial plant costs [1] are said to range from $20,000 to $60,000, depending upon capacity, and recoveries are in the order of 80 to 95 per cent. An operating cost of $1.44 per ton [2] is given for one foundry handling 3 tons of core sand per hour.

Although the dry thermal process has not been used as yet in ferrous foundries, owing to the impossibility of adequately removing clay coatings from grains by this method, results of experimental work involving dry scrubbing with controlled air classification are said to be encouraging.[3] Thermal treatment is combined with scrubbing methods in one reclamation system on the market.

3. Wet Reclamation

Wet reclamation systems are the only ones now used in ferrous foundries and, in general, are comprised of the following basic steps:

(a) Screening of sand with removal of tramp metal.

(b) Wet scrubbing in a muller or other suitable unit to remove baked clay coatings and carbonaceous material from sand grains.

(c) Dewatering of sand by filtration, draining, or centrifuging, usually followed by drying in a rotary or other dryer.

In some cases, where bentonite and clay are the chief binders used, sufficient scrubbing of the sand may result from pumping alone, in which case no further provision for mulling may be necessary. However, where organic binders are used to any extent, relatively violent scrubbing is usually necessary to remove tenacious oil and graphitic coatings from sand grains.

The cleaned product from wet reclamation systems is substantially free of inorganic impurities, but total elimination of the organic constituents is rarely possible by this method. Wet reclamation is commonly combined with the hydro-blast system for cleaning castings, in which event part of the cleaned sand is diverted to blast use and recirculated through the system. One such installation is in operation at a local foundry.

The sand reclaimed by wet processing, although somewhat different in appearance and properties from new sand, is usable for molding and certain core work. For a considerable proportion of core preparation, however, the complete removal of oxidized oils and graphitic material is highly desirable.

Combination of Methods

One commercial reclamation scheme combines both wet and thermal methods to give a final product which is roughly comparable in properties to new sand. This is accomplished by wet-scrubbing in a roller-type mixer, desliming in a counter-current classifier, dewatering in a screw conveyor, and heating to temperatures of 1200-1500 F in a rotating hearth furnace.

The cost of rejuvenating sand by wet reclamation methods is said to range from $0.20 to $1.50 per ton in operating plants.[4] Capacities of installations now in operation usually are in the order of 5 to 15 tons per hour, although in a few cases as little as 2 tons per hour may be treated. Costs of wet reclamation systems in general range from $15,000 to $80,000 or more, depending upon size and complexity.

Type and details of the reclamation process to be selected by a foundry depend upon such factors as sand practice, degree of cleaning desired, cost of new sand and scale of operation. However, for steel foundries some form of wet scrubbing, followed by hydraulic classification, seems to offer the greatest promise, particularly when combined with thermal treatment for elimination of carbonaceous impurities.

The chief problem connected with sand reclamation in British Columbia is the relatively small size of individual foundries. The total quantity of new silica sand consumed by all steel foundries in the Province does not exceed 4000 to 5000 tons per year, and that used in the Vancouver area is less than 3000 tons. The largest individual consumers use little more than 1000 tons per year. The result is that standard recovery systems, although suitable for large tonnages, have too great capacity and are too high in capital cost for serious consideration by individual local foundries. On the other hand, the expense connected with the use of imported sand makes the possibility of reclamation a matter of considerable interest.

With these considerations in view, the investigation carried out by the British Columbia Research Council has been directed toward the possibility of economical sand reclamation by methods adapted to conditions.

Experimental Work Details

It was decided that wet scrubbing, alone or in conjunction with furnace treatment, offered the greatest promise for processing of waste sand from local steel foundries. Samples of waste sand were obtained from three steel foundries in Vancouver, and preliminary tests were made to determine the most suitable treatment method. The following procedure finally was adopted for small-scale testing:

(1) Scrubbing for 10 min in a laboratory Fagergren type flotation cell at 50 per cent solids with the addition of about one lb of caustic soda per ton. The use of caustic soda gave a marked improvement in scrubbing efficiency and slime disposal.

(2) Removal of suspended clay, carbon, and fines by successive washing and decantation in a large beaker, continued until decanted liquid was clear.

(3) Drying of washed sand in a laboratory oven. After drying, the product was gray in color and grains showed a considerable amount of adhering carbon under the microscope. Clay coatings, however, had been effectively removed by the treatment.

(4) The dried sand was heated to 1500 F in silica dishes in an electric muffle furnace for a period of 30 min. The products from this operation resembled new sand except for a generally creamy color and the presence of a small proportion of small black particles. Microscopic examination showed these particles to consist of either iron oxide scale or glassy slag.

(5) The coarse scale and slag particles were removed by passing the sand through a 30-mesh screen, while the smaller particles were removed by passing the sand through a magnetic separator.

The final sand products resulting from treatment of the samples of reject sand from three steel foundries were similar in appearance and general properties. Microscopic examination indicated that the sand grains were clean and relatively free from adherent coatings, and that fines and slimes had been effectively removed. On the basis of these results, tests were run on a larger scale in an attempt to approximate actual operation conditions.

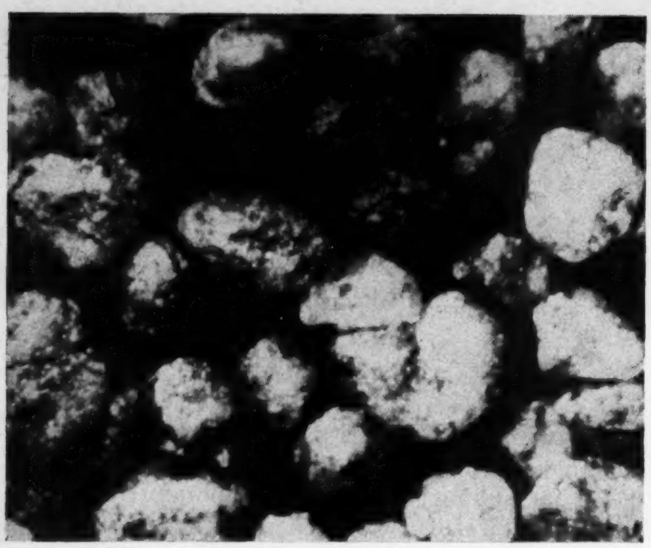
About half a ton of waste sand was obtained from one of the local steel foundries, and passed through an

Table 1—Screen Analyses Comparison

Screen Number	Retained on Screen, Per Cent				
	Classified Sand		Table Sand		New Sand
	Dried	Calcined	Dried	Calcined	
+ 30	1.3	0.7	0.3	0.8	—
— 30 + 40	3.1	2.3	1.8	2.6	2
— 40 + 50	32.3	26.2	28.9	32.7	38
— 50 + 70	50.7	47.8	46.7	41.8	26
— 70 +100	2.7	15.7	14.4	13.3	20
—100 +140	6.3	3.5	4.6	3.9	9
—140	3.8	3.8	3.8	4.9	5

Table 2—Screen Analyses of Reclaimed Sands

Screen Number	Retained on Screen, Per Cent				
	Reclaimed Sand			Typical New Sand	
	Foundry A	Foundry B	Foundry C	Regular	Coarse
— 20 + 30	0.4	0.4	3.7	0.1	1.6
— 30 + 40	11.8	4.5	27.9	0.8	56.6
— 40 + 50	0.36	24.4	27.0	19.6	31.7
— 50 + 70	35.6	46.2	26.4	45.4	7.4
— 70 +100	11.4	17.0	11.1	21.2	1.8
—100 +140	0.2	5.3	3.2	9.9	0.1
—140	4.5	2.2	0.7	3.0	0.8



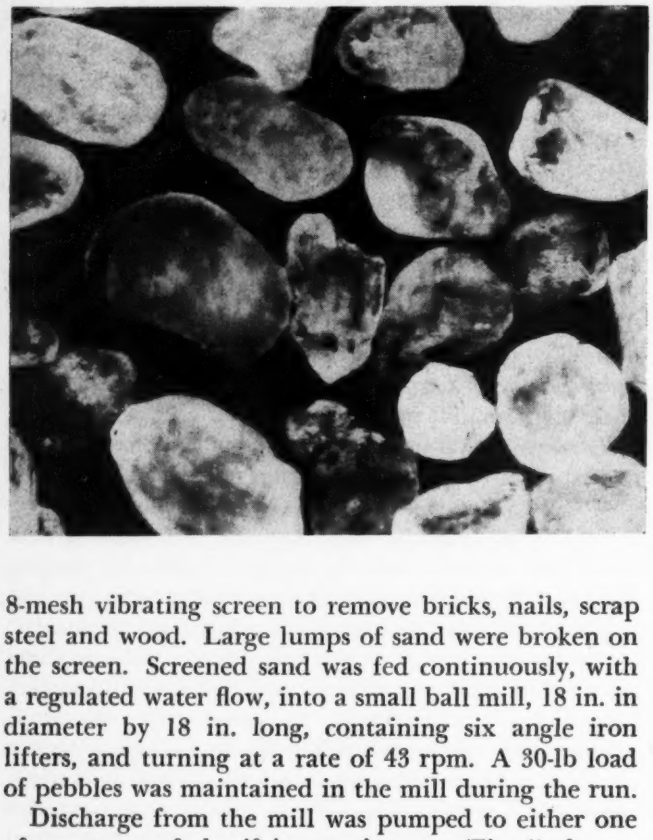


Fig. 3—Reclaimed sand in various stages of processing; (left above) crude sand discarded by foundry; (above) classified product; (left) final product. ×50.

8-mesh vibrating screen to remove bricks, nails, scrap steel and wood. Large lumps of sand were broken on the screen. Screened sand was fed continuously, with a regulated water flow, into a small ball mill, 18 in. in diameter by 18 in. long, containing six angle iron lifters, and turning at a rate of 43 rpm. A 30-lb load of pebbles was maintained in the mill during the run.

Discharge from the mill was pumped to either one of two types of classifying equipment (Fig. 1) for removal of fines: (a) rake classifier, or (b) Wilfley table.

(a) A small laboratory rake classifier, 5 ft long and 8 in. wide, was used to deslime the mill discharge. Rate of feed, overflow, pulp dilution, slope, and rake speed were adjusted to give an overflow product finer than 150-mesh, and a sand product substantially free of suspended slimes. To aid in thorough washing of the sand product, water sprays were used near the discharge end.

(b) As an alternative to the rake classifier, the mill discharge was pumped over a small laboratory-type Wilfley table with a 38x16-in. deck. This proved to be an exceptionally efficient means of eliminating undesirable fines and slimes, and at the same time permitted the cutting out of fine slag, scale, and tramp iron products. Control of the process was simpler with the table than with the classifier on the scale of tests made.

Scrubbed and classified sand from both treatment methods was dried, and calcined in a small, continuous, gas-fired roasting furnace consisting of a single hearth 18 in. in diameter with rotating rabble arms. The sand was fed continuously through an opening in the center of the roof and removed automatically by the rabble arms at the periphery of the furnace. The sand was subjected to a heating cycle of about 5 min, of which 3 to 4 min were at a temperature of 1400-1450 F.

The calcined product was slightly yellowish in color and contained particles of scale and slag as before. These impurities were almost entirely eliminated by passing the sand through a magnetic separator.

The rate of feed used (250 lb per hr) represented the maximum which could be satisfactorily scrubbed with the mill available. It is felt that this could have been substantially increased if it had been possible to operate the mill at higher speed, and if steel punchings or slugs had been substituted for the pebbles used. The classifier also was operating at maximum capacity at this feed rate, but the Wilfley table could have handled at least 50 per cent more material without loss of efficiency. The three samples from local steel foundries were treated similarly, for purposes of comparison.

Screen analyses of new sand are compared with those of classified sand, tabled sand, and both sands after calcination (Table 1), and it is apparent that:

1. There is little practical difference in sizing of final products whether the classifier or table is used.

2. The size distribution of reclaimed sands is not very different from that of new sand. In each case 85 to 90 per cent of the total weight of each sample is in the −40 +70 mesh range, or in other words, lies on three adjacent screens.

Table 2 shows a comparison made between screen analyses of reclaimed products from each of the three waste sands investigated. Again it is apparent that

reasonably close approximations to new sand can be obtained. In this connection it should also be emphasized that the use of the Wilfley table permits considerable control of the sizing of final sand products, since it is possible to recover a number of differently sized products from it simultaneously for recombustion as desired.

In appearance, scrubbed and deslimed sand is light gray in color, compared with cream to light buff for the final calcined product, and black for the original sand (Fig. 2).

Organic Matter Removed

Under the microscope, the gray color of the noncalcined product is seen to be due to small flakes and coatings of black carbonaceous material adhering to otherwise clean quartz grains. Although nearly complete elimination of clay can be effected, it was found impossible to remove a large proportion of this carbonaceous material by any practical degree of scrubbing. By calcination, however, the organic matter is almost completely removed, resulting in light-colored sand discolored only by iron stains on some quartz grains, and a small proportion of black scale and slag particles. These latter can be almost entirely removed by the magnetic separator if desired.

Scrubbed and classified sand might be entirely suitable for certain molding purposes and some core work without further calcining treatment. Used for molds it probably would have lower permeability, higher green strength, and probably higher hot strength than would new sands, and for cores would require more oil and would collapse less readily. In practice there might also be an increasing build-up of carbonaceous matter with cyclic use and cleaning of sand. Calcination provides almost complete elimination of organic matter, leaving a final product which could be substituted for new sand for nearly every requirement.

The slight iron stain which gives the final calcined product its yellowish hue would not be deleterious in any way for foundry work. The small slag and scale particles in the sand, if present in any appreciable amount, might tend to cause metal penetration owing to their lower fusibility. These can be simply removed by magnetic means, but it is doubtful if this step would be necessary in practice, particularly where tabling had been used previously for desliming.

Photographs of reclaimed sand in various stages of processing are shown in Fig. 3.

Proposed Reclamation System

On the basis of the experimental work done, it appears practical for the relatively small foundry to install a low-priced plant which will give adequate reclamation of sand on an economical basis. This is particularly true if, in an area such as Vancouver, such a plant could be used to treat waste sand from several foundries.

The proposed sand reclamation system would include the following three basic steps: (1) Scrubbing; (2) classification; (3) calcining.

1. Scrubbing could be carried out in one of several types of relatively cheap units, such as a ball mill,

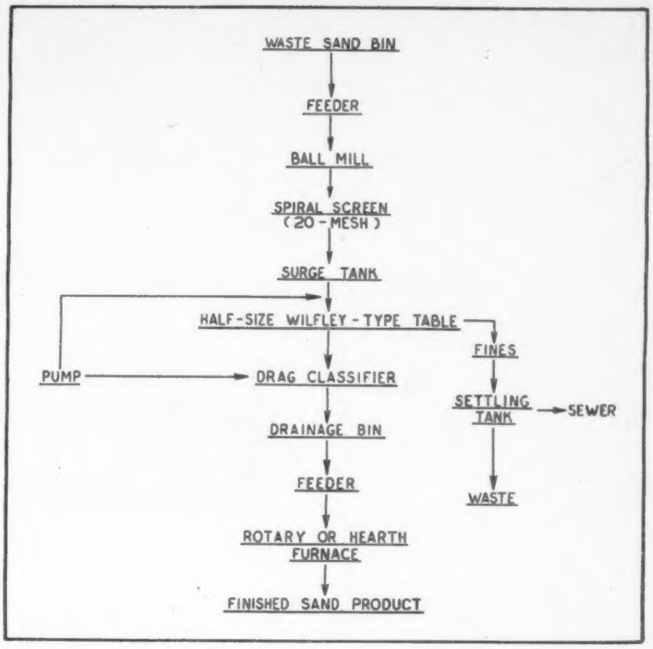


Fig. 4—Flow sheet diagram for sand reclamation plant having approximate capacity of one ton per hour.

rotating steel drum with lifters, or a modified cement mixer. A muller-type sand mixer would be entirely suitable if already available in a foundry. After screening for removal of tramp iron, sand would be fed to the scrubber with 30 to 40 per cent water. Actual scrubbing time would depend upon the unit selected, but with a continuous operation the unit probably would need to be of sufficient size to provide from 5 to 15 min of relatively intense treatment. The mill used in the pilot run described had an effective volume, as operated, of about ½ cu ft, which corresponded to an agitation time of about 8 min. In this case, more scrubbing would have been desirable, which would have required either greater turbulence or a larger mill. It is suggested that a small ball mill, or rotable steel drum with lifters, might be used for this purpose, and that dimensions of 3-ft diameter by 4-ft length would provide adequate capacity for about one ton per hour of sand feed. A standard ball mill of this size would cost about $2500, but a suitable steel drum on rollers probably could be constructed locally at less cost. Power required to operate equipment of this capacity would be from 5 to 10 hp.

2. Discharge from the scrubber would go to some form of classifying device, for which one of several types of equipment, i.e., rake or spiral classifiers, rising current classifiers, or Wilfley-type tables might be used. Selection of the most desirable unit would depend largely on price and available space. The shaking table has several features which recommend it for this service: ease of operation by unskilled labor; highly efficient desliming action; possibility of eliminating undesirable constituents such as fine tramp iron, scale, brick, and slag; and possibility of simultaneously cutting out as many roughly sized products as desired. On the other hand, water consumption is relatively

(Concluded on Page 65)

Making the Foundry a GOOD PLACE to Work!

AMPLE EVIDENCE EXISTS indicating that post-war demands upon the foundry industry are such that its greatest production cannot satisfy the demands placed upon it for castings. This situation, however, could be alleviated in large measure if more employees could be obtained to man the foundries.

Many employment managers appear to have taken the view that only old foundry workers or men who cannot obtain other jobs, will apply for work. Their attitude seems to be that foundries in general are not attractive places of employment and that sub-standard environmental conditions, including health, safety, lighting, noise and sanitation must be taken for granted by a prospective employee.

Fortunately, a growing number of forward looking foundrymen believe that working conditions can be so improved that workmen will readily seek the opportunity of learning the trade in well managed modern foundries.

It must be recognized, however, that in adopting this opinion management must be prepared to make major changes involving a considerable outlay of funds for modernization of the plant, including mechanization of many processes. Such an outlay of funds, of course, can be contemplated only on the basis of a reasonable increase in production accompanied by a lowered unit cost of castings.

The modernization of one aluminum foundry,* engaged in the production of lasts for rubber footwear and similar castings, should be of interest because many of the management-labor problems involved, as well as mechanization of processes, are directly related to the problems of any type of foundry.

Early in 1944 it became apparent that it would be practically impossible to keep abreast of production requirements without expanding the foundry area and hiring additional workers. Both of these possibilities were found impracticable, adjoining plant areas not being available and because new workers, such as were available in a tight labor market, were not interested in foundry work.

At this time the State Bureau of Industrial Hygiene was called in to undertake air studies to determine the extent of the industrial health hazards. These studies resulted in the presentation of certain recommendations for the use of personal

This article is a digest from a paper by L. W. Woodhouse, Industrial Hygiene Engineer, Bureau of Industrial Hygiene, Connecticut State Dept. of Health, presented at the 1947 New England Foundry Conference as the Luman S. Brown Lecture.

* Shoe Hardware Div., U. S. Rubber Co., Waterbury, Conn.

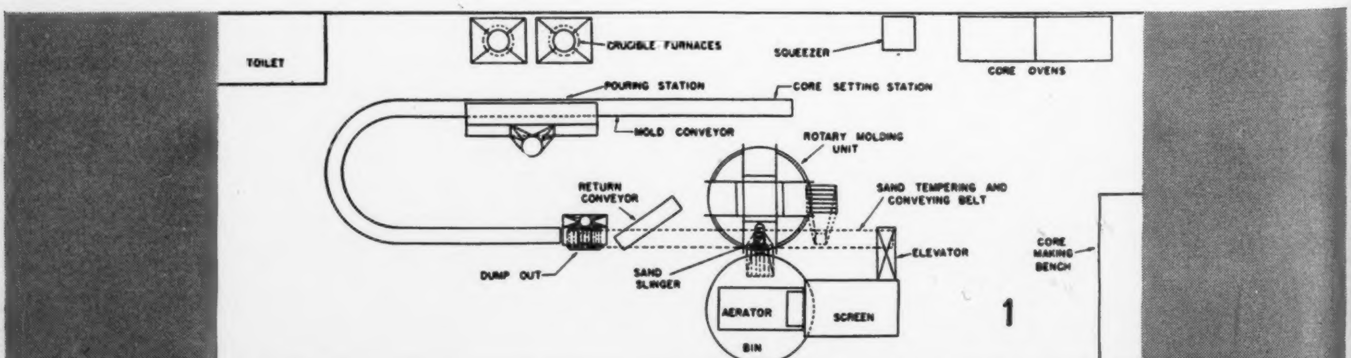
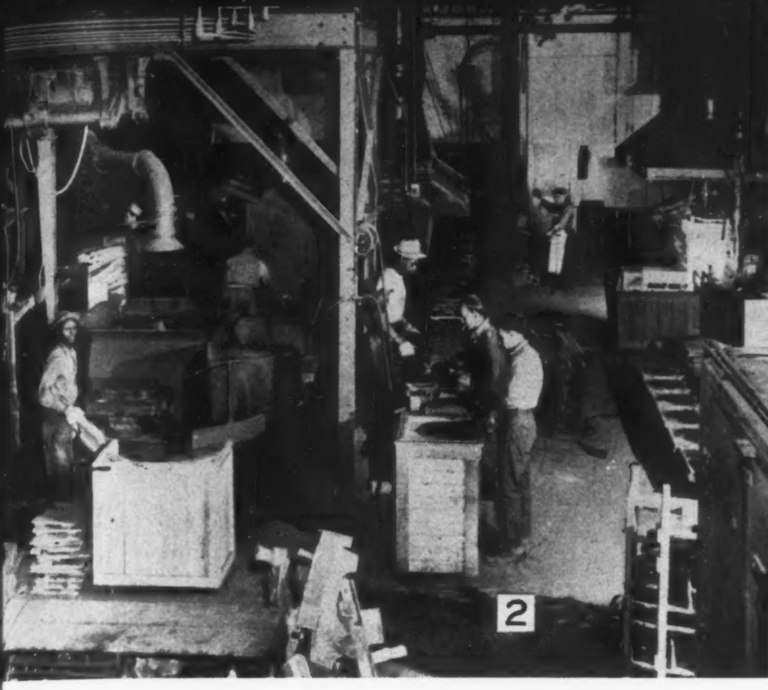


Fig. 1—Compact layout of modernized aluminum foundry showing 4-station rotary molding turntable and stations for core setting, pouring and dump-out on roller conveyor line, in relation to core sand conditioning, coremaking and baking, melting, and sand return.



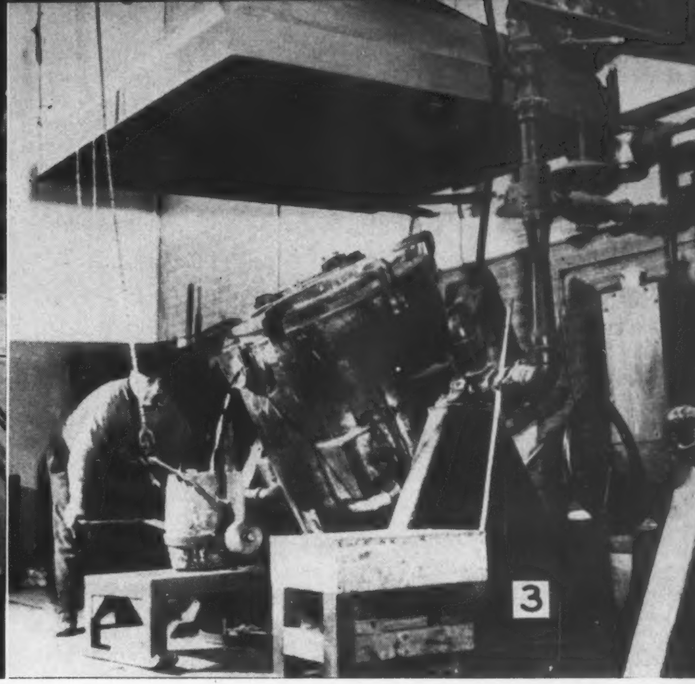


Fig. 2—The heart of the foundry as modernized is a turntable molding unit (left) having four working stations: (1) Pattern and flask assembly; (2) sand ramming; (3) cope or drag struck off; (4) bottom boards set on drag, pattern stripped and half molds removed, rolled over and placed on a roller conveyor for setting cores and closing molds. This molding process has been adopted in lieu of hand and squeezer machine molding, for the most part. Excess sand returns to the system.

Fig. 3—Aluminum is melted in two 400-lb gas-fired crucible-type melters equipped with canopy hood to mechanically exhaust heat and fumes. The ladle is lifted by a small hoist and manually transported by overhead monorail to the mold pouring station.

Fig. 4—A combination canopy and lateral mechanical exhaust hood is provided at the pouring station on the conveyor line for control of dust, heat, smoke and fumes. After pouring, each batch of molds is allowed to cool for a short time before advancing to dump-out.

Fig. 5—After cooling, molds are moved along the roller conveyor to a manual dump-out equipped with a mechanical exhaust hood. Sand drops through an open grating to a tempering belt within an exhausted underfloor tunnel, whence it is transferred to an enclosed and exhausted bucket elevator which discharges at the top of the enclosed and exhausted sand conditioning unit. Here the sand is screened, aerated and passed to a 10-ton storage bin equipped with horizontal plate feeder delivering directly to hopper of molding unit. Bottom boards and flasks return to molding station.

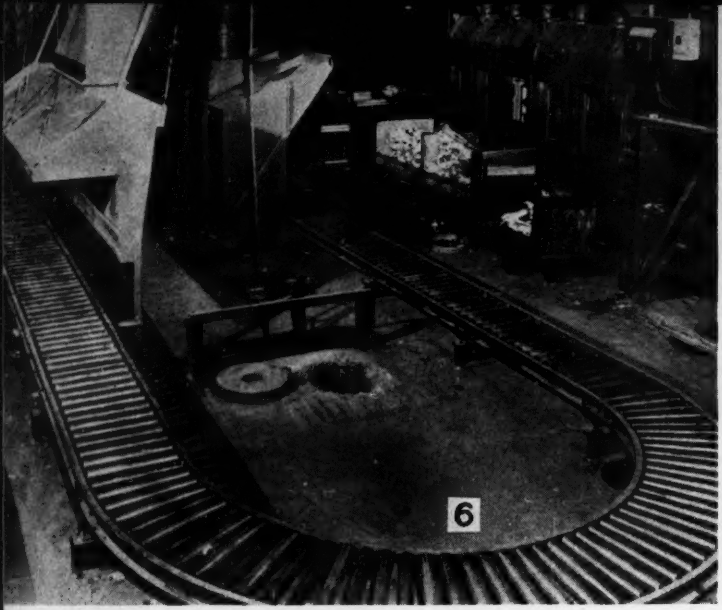


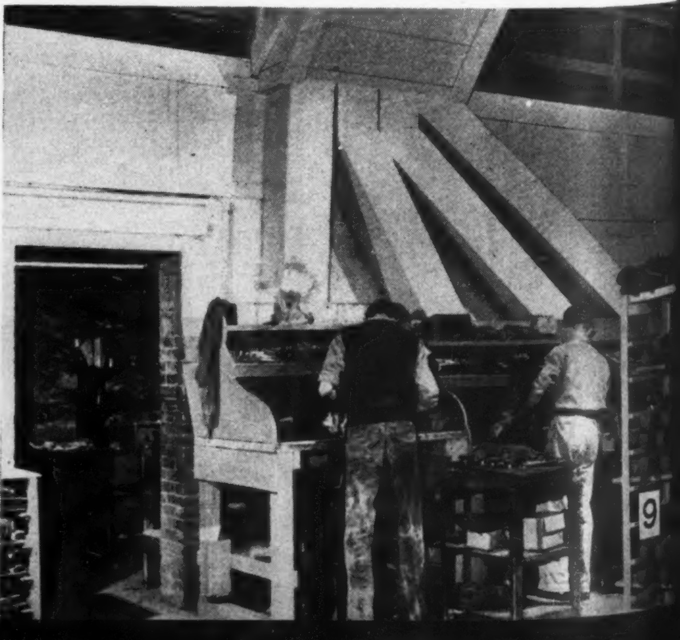
Fig. 6—View of roller-conveyor line, showing mechanically exhausted hoods at pouring station (left) and at dump-out (right center). All exhaust air movement for the sand conditioning and handling system is provided by a central exhaust unit. The conveyor line is sufficiently long for holding molds in process and limits the lifting load of any worker to half the weight of a mold through a distance of not over three feet.

Fig. 7—Cored castings removed at the dump-out are first rack cooled, transferred temporarily to a bin, then placed in a core rap-out cabinet divided into six compartments, each lined with insulation material and fitted with double glass sliding doors to reduce noise. Each compartment is louvered to admit air. Fine dust is exhausted from the top through the central exhaust system. Core sand is collected periodically.

* * * *

Fig. 8—From the rap-out cabinet (Fig. 7) shoe last castings are hand trucked to finishing line and first given low-pressure internal water wash to remove all traces of core sand, a process that replaced high-pressure air blowing with attendant dust. All finishing is performed at hooded and exhausted grinding and polishing jacks with artificial abrasive wheels. Provisions for exhaust are maintained considerably in excess of those recommended in the A.F.A. and ASA code for GRINDING, POLISHING AND BUFFING EQUIPMENT SANITATION.

Fig. 9—Originally, much laborious work was involved in trucking, hand cutting and mixing core sand. Now core sand is trucked from the street and brought directly to second floor level. After being mulled, it is dumped into a hopper and fed by gravity chutes to four core benches on the foundry level. The core baking operation has been simplified by provision of rack trucks which are loaded into two gas-fired, air-circulating core ovens. These units, equipped with automatic temperature controls, have greatly improved the practice.



protective equipment and the improvement of exhaust ventilation for control of atmospheric dust.

Local management then consulted with the company's safety engineer and industrial hygienist, various equipment engineers, and engineers from the State Bureau of Industrial Hygiene, and the recommendation was made that complete modernization be undertaken. After all facts and figures were assembled, an appropriation of approximately 100,000 was allotted by top management for the work.

Plant Improvements

Illustrations herewith depict some of the mechanical improvements achieved with safety and hygiene betterments in mind. In addition, an important part of the plant modernization program involved wash, locker and toilet room facilities, and medical examination and follow-up.

Prospective workers are given a thorough interview by the employment department and a medical check before beginning work. In the event of a previous history of silicosis, tuberculosis or other disabling condition, the worker may not be certified for foundry work.

Adequate wash and locker rooms, located near the foundry entrance, were planned with the thought that a foundry worker will be more respected by his family and other workers if he meets the public in clean clothes. Complete wash and shower facilities are provided, and men are encouraged to use them. He has a clean place to hang his street clothes, and a place to dry his work clothes while off the job. Toilet rooms are airy, clean, spacious and well lighted, located directly off the foundry floor and readily accessible.

Physical Examinations

Medical facilities were carefully planned to make available all necessary services, including such details as suitable waiting and consultation rooms. A physician makes regular daily visits to the plant to examine new employees and consult on general health problems and injuries. In addition, registered nurses are in attendance at all times. A panel of specialists, as well as the plant physician, are on call in case of serious injury, and arrangements have been made with a local hospital for preemployment and periodic chest x-rays of foundry workers.

Today, upon entering this foundry for the first time a new worker or a guest unfamiliar with the processes would not at once realize that he is in a foundry. The popular mental picture of men and equipment dimly outlined through clouds of smoke and dust just does not exist. Instead one sees an orderly, well-lighted shop where no one is asked to work under conditions unduly dangerous to life or limb or which are, by comparison with other industries in the same community, either particularly arduous or unpleasant.

Inasmuch as the modernization of this foundry has been completed only recently, it is not possible to ascertain exactly what economies of operation have been gained. On the other hand, it has been definitely established that difficulty in obtaining new workers no longer exists. In fact, the 1944 total of 20 workers in the foundry and finishing department today is over 30. Production per man has materially increased and is expected to go much higher when each worker becomes familiar with the mechanical equipment.

Medical Program

While the improvements discussed herein are related to a specific foundry, the principles involved are universal in application. The medical program, for example, may always be set up to provide preplacement physical examinations including chest x-ray diagnosis, periodic re-examination, regular medical consultation service and nursing care.

The large foundry, or the smaller captive foundry operating as part of a big plant, may provide an extensive hospital with a full-time physician in charge, a corps of nurses and elaborate equipment including x-ray apparatus. On the other hand, the small foundry may extend the same protection to its workers through a physician specializing in foundry problems who will take the responsibility of setting up a medical program. This is particularly true in the larger industrial centers where a single medical unit may be set up to serve several small establishments in the industry.

The mechanization of processes, which has so great a bearing on the possibility of dust and heat control and the elimination of a great proportion of manual handling of materials, must be engineered on a "tailor-made" basis. Practically speaking, no two foundries are alike. On the other hand, irrespective of local conditions, mechanization together with modernization of medical facilities, lighting, sanitation and housekeeping will pay dividends in improved employee health and output per man.

Teaching Aids Offered To Industrial Firms

A SERIES of teaching guides, developed by the Air Service Command, for training job supervisors in industrial plants are now on sale by the Office of Technical Services, Department of Commerce, Washington 25, D. C. Although developed for wartime use in defense plants, the guides are believed to be applicable for training foremen and job supervisors in peacetime.

Each of the training guides covers a two-hour conference session between the instructor or group leader and the conferees and includes visual teaching aids, illustrative case histories and teaching techniques.

Some of the subjects are: Getting the Work Done, Job Instruction Methods, Developing Initiative and Confidence, Using the Reprimand, Sizing Up the Problem and numerous others.

Chest X-ray Service For Michigan Plants

AVAILABLE TO the foundry industry in Michigan is a mobile unit equipped to make regular x-ray examinations of foundry employees. Type of equipment used necessitates employees to be away from the job only a short time. Celluloid films, 14 x 7, are used and interpretation of films are forwarded in duplicate to management within approximately ten days. Interested foundries in Michigan are urged to contact Dr. Edward W. Laboe, 207 E. Grand River, Howell, Mich., for further information.

FOUNDRY COSTS AND COST CONTROLS

C. E. Westover
Westover Engineers
Milwaukee

THE COST COMMITTEE of the American Foundrymen's Association was one of the first set up by the Association, and since its inception has been among the most active. Great effort has been expended by A.F.A. Cost Committee members, and also by the various societies representing the several branches of the industry, to develop a uniform accounting system and uniform method of figuring costs worthy of adoption by the foundry industry. The value of a plan of this type cannot be minimized today, although a number of years have passed since the need for it became apparent.

A.F.A. Cost Committee Papers

A perusal of all papers written on the subject of costs since inauguration of A.F.A. 51 years ago would provide sufficient material to make a most appropriate present-day paper. There is one paragraph, however, which might have appeared in any paper reflecting present-day conditions. It appeared in a paper entitled "Uniform Costs in the Foundry Industry" presented at the annual meeting of the Association in Philadelphia, September 29-October 3, 1919. It reads as follows:

"Perhaps the greatest problem before American industry today is that of determining accurate cost of production. Industry is becoming so complex—our tax laws are so intricate and the matter of accurate returns is so important that the concern operating without knowledge of costs is in the least possible position to conduct its business to best advantage. Another, and perhaps the most important reason why costs must be accurately ascertained, is that, to enable the manufacturer to determine just what he can voluntarily do in the way of increasing wages and arranging for profit-sharing plans if necessary to offset the unreasonable demands on the part of his workers, he must know where he stands with reference to his production costs."

If industry in 1919 was so complex as to provoke these comments, it must also have been complex when the first A.F.A. Cost Committee was set up over 50 years ago. Certainly, it remains complex to a certain degree today. Insofar as detailed reports and statistics for government and tax purposes are concerned, they no longer present the management problem created when the practice originated. The amount of information demanded in these reports over the years has increased considerably, but industry has taken this in stride, meeting the challenge by an increase in or the reorganization of personnel. In many cases, passage of the Social Security Act and Withholding Tax laws required the hiring of additional personnel, but this information was required by law and industry cooperated to the fullest extent.

It is regrettable that the castings industry has not adopted the same attitude and expended the same energy in the matter of determining its costs by establishing departments to obtain this information. It is doubtful if there is a plant in any branch of the castings industry, which was in existence during the war, that has not had its productive capacity increased materially, and probably to the point where it is in excess of normal requirements. During the war, and since, many new units have been added, especially in the gray iron and non-ferrous branches of the industry, because of continued abnormal demands for these types of castings. Improved production and management methods and techniques have resulted in a substantial increase in production per man-hour, but still no effort has been made to develop a plan whereby costs are predetermined.

Need for Sound Cost System

The marginal foundry, that foundry which is unable to figure its costs and sell at a profit will not be in existence once the first bulge of consumer demand is satisfied, and the semi-marginal foundry will find itself in serious difficulties. Thus, the familiar struggle for survival which has characterized the foundry industry as a part of a free enterprise system will be on in earnest. Let us not be too hasty in discarding this system, since it has proved to be the foundation of our rapid industrial growth and is responsible for the degree of efficiency which our industries maintain in comparison with that of other nations. Rather, let us be efficient and determine our costs. It is only in this way that we can hope to remain in business. The greatest contribution any foundryman can make toward stability of the industry is to operate his business profitably.

Cost Control and Cost Accounting

The cost accounting systems advocated by A.F.A. and other societies will give you your costs, but, as such, they are purely historical records—records of what has taken place. Generally speaking, the accounting department is the gatherer, keeper, and dispenser of the figures necessary to prepare financial statements which meet the requirements of the business and the government.

Too few accounting departments include in their function the figuring of job costs or participate in cost control work. Cost control and cost accounting are two distinct functions and are usually the responsibility of separate individuals in even small organizations. Cost control is a method of predetermining costs; cost accounting is a matter of recording what has taken place.

Usually accounting occupies a high position in the administration of business, due to the fact that statements must be prepared and presented at definite times; whereas, cost control work is like production: if you cannot deliver this week, then deliver next week.

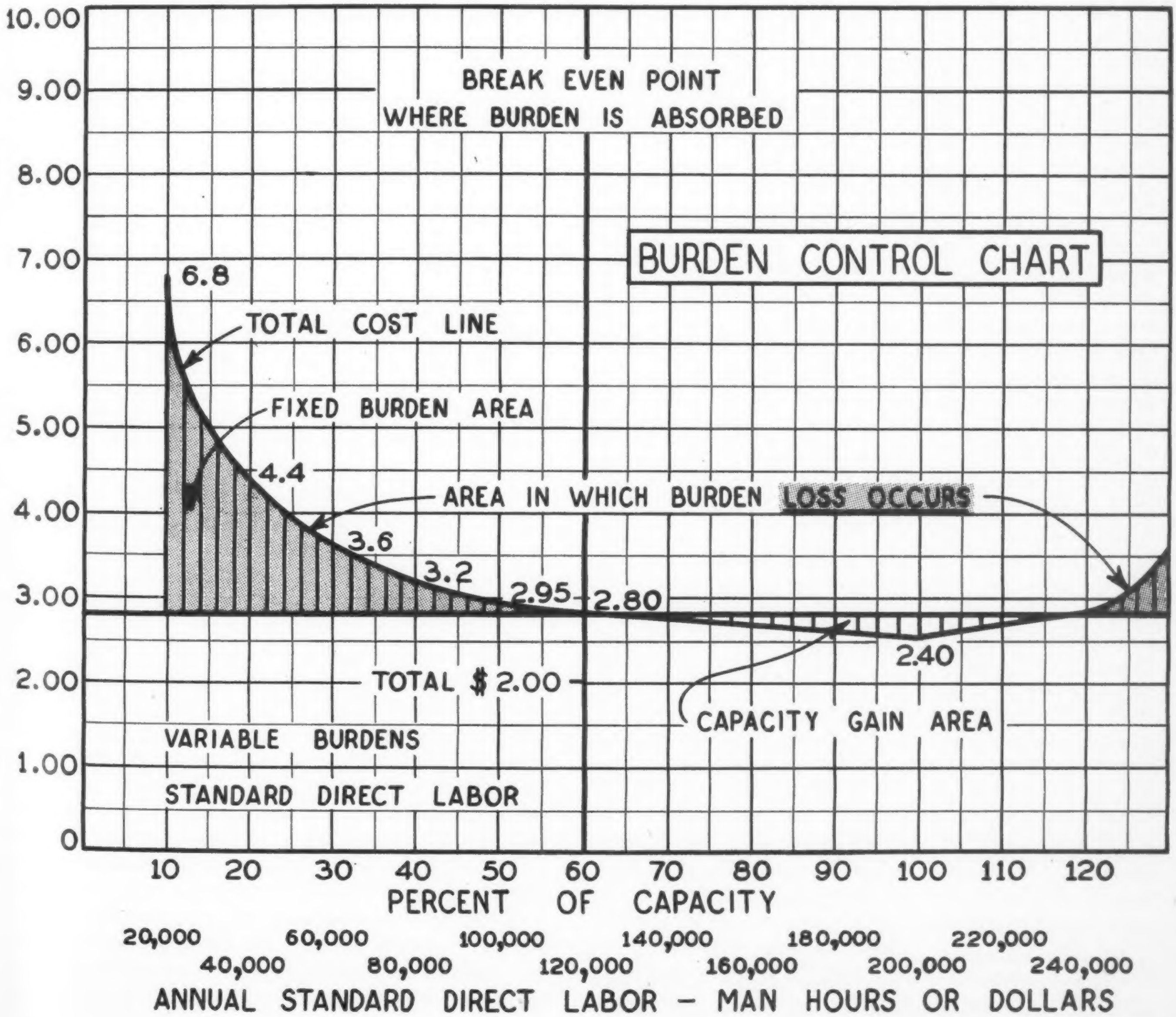
Management must be brought to recognize accounting and cost control work as two distinctly different functions or departments, but of equal importance in the operation of a business. Of course, close cooperation between the two departments is essential.

Financial and Control Budgets

The most effective system will center around financial and control budgets. Financial budgets, dollar value budgets, may be set up on sales forecasts. This will indicate profits for a given amount of sales produced at a predetermined cost. Of course, production processes, methods, wages and the like do not remain static. Therefore, budgets for control purposes must be both flexible and perpetual, adjusted to meet changing conditions, and be at all times reflective of actual operating conditions. Control budgets, to be most effective, should be expressed, wherever possible, in stable measures, such as, time (minutes or hours), weight (pounds or tons). At times, however, it is necessary to use money as a measure. A control budget may resolve itself into a chart or series of charts, for the plant as a whole or for a department covering labor or material.

One problem which concerns management is a loss in certain departments due to a decline in the volume of production in that department. The business as a whole may be operating at a satisfactory profit, but when each department is analyzed, one or more departments may reflect loss. The cause is usually that these departments are partly or wholly shut down, while fixed costs continue. A common example of this

Fig. 1—Burden control chart showing break-even points.



may be the balancing of core room operations with the molding department. Where management decides to establish, for cost purposes, a minimum volume or percent of plant capacity as the break-even point, it is then advisable to establish the point for each department.

In making an analysis it is advisable to follow a definite plan or pattern whereby:

1. Fixed costs of the department are calculated.

2. The semi-variable costs of the department are carefully analyzed and budgeted to determine the fixed and variable elements.

3. The standard direct labor, hours or dollars, required to absorb the fixed costs are determined.

If these calculations are expressed in simple chart form, the necessary production volume to break even will be readily ascertainable. A careful recording of figures may also develop the point in operations of diminishing returns or increasing burdens. Charts can be developed using various units of measure.

Break-Even Point

The accompanying chart, Fig. 1, illustrates graphically the break-even point for the plant or for a given department operating at 60 per cent of capacity, the selected point upon which to base costs.

The horizontal scales of Fig. 1 show the annual standard direct labor cost in man hours or dollars for varying percentages of capacity. For instance, at 60 per cent of capacity the total annual standard direct labor is 120,000 man hours, and may or may not be $120,000.00, depending on wage rates and whether they remain constant thru the year.

Vertically, Fig. 1 shows the changing ratio of total cost to standard direct labor cost. In this chart the break-even or burden absorption point is 60 per cent of capacity and the ratio of total cost to the standard direct labor cost at this capacity is 2.8. At this point the ratio or total manufacturing cost is made up of 1 unit of measure of standard direct labor, 1 unit of measure of variable burden cost and 0.8 unit fixed burden cost.

If operations were at 40 per cent of capacity, the ratio would then be 3.2. This ratio of total cost would then be 1 unit of standard direct labor cost, 1 unit of variable burden cost, and 1.7 units of fixed burden cost.

The difference between these two ratios, multiplied by the total annual standard direct labor cost at 40 per cent capacity level, will give the loss which will be experienced. This loss is due to failure to supply the plant or department with sufficient production volume to maintain capacity at the burden absorption point which is at the 60 per cent capacity level.

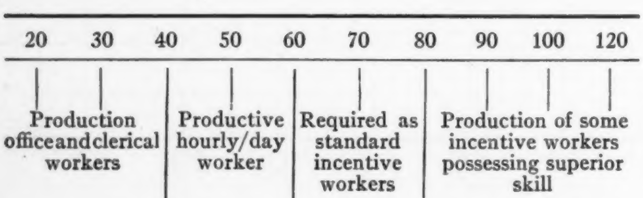


Fig. 2 — Performance of Hourly and Incentive Workers.

As an example, assume a production of 360,000 units at 60 per cent capacity. Then the manufacturing cost would be:

Standard direct labor	$120,000
Variable burden cost	120,000
Fixed burden cost	96,000
Total manufacturing cost	$336,000

Cost per unit at this capacity would be 336,000 ÷ 360,000 or $0.933.

At 40 per cent capacity level there would be production of 240,000 units and manufacturing cost would be:

Standard direct labor	$ 80,000
Variable burden cost	80,000
Fixed burden cost	96,000
Total manufacturing cost	$256,000

Cost per unit at this capacity would be 256,000 ÷ 240,000 or $1.066.

Actual standard cost at 40 per cent capacity	$1.066
Standard cost at 60 per cent capacity	$0.933
Additional cost	$0.133 per unit

Therefore, with production at the 40 per cent capacity level (240,000 units) the plant or department would suffer a loss due to production variance of 240,000 units multiplied by 0.133 or $32,000.

According to the chart, the total standard manufacturing cost at the 60 per cent capacity level, is 2.80 per dollar of standard direct labor. At 40 per cent capacity level, total standard manufacturing cost is 3.20 or an increase of 0.40 per dollar of standard direct labor.

Inasmuch as there are 80,000 of standard direct labor cost at the 40 per cent capacity level, this cost multiplied by 0.40 indicates a loss due to reduced production of 80,000 × 0.40 or $32,000. This figure compares with the loss shown in the foregoing example.

The principle of the above illustration is applicable to various problems and can be most useful in determining sales policies, pricing and effort.

Object of Cost Control

The object of cost control should be cost reduction, which may be accomplished through greater productivity per manhour, improved methods, techniques, mechanization and/or economical use of materials. It must be remembered, however, that labor is the predominant cost factor in the production of castings.

A main objective of American industry is to make a better product at a lower cost. Only ever increasing productivity per manhour will make it possible to maintain or reduce selling price, improve quality and pay higher wages. And, unless high wages are accompanied by high output, costs and selling prices of castings will be too exorbitant to encourage their use as a structural material or to provide the volume of business necessary to use a fair percentage of capacity.

Properly organized plans for cost control will automatically provide a cost reduction program, since these plans call for establishing standards of operation which determine materials used in production, methods of

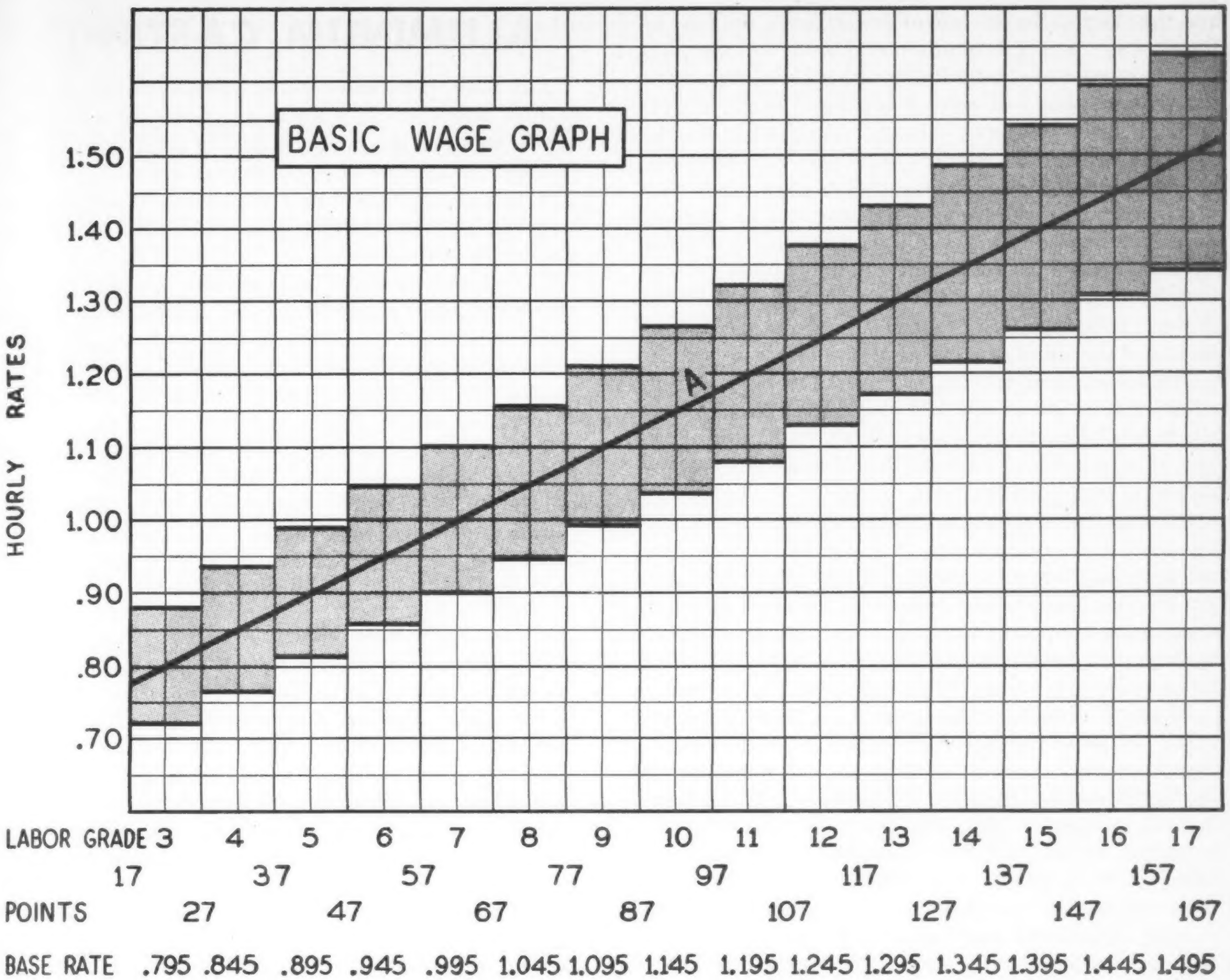


Fig. 3—Method of establishing conversion figure.

production and quality standards. Only after operation standards have been established can standards of performance for operators be set.

Without going into time standards, which is in the field of the A.F.A. Committee on Job Evaluation and Time Study, it will be sufficient to say that time is a stable measure. Time will measure effectiveness of materials, efficiency of methods and quality requirements, as well as the amount of work required to perform an operation. Such time standards should be in the form of standard data, which means element time and not over-all time, thus enabling the cost control department to analyze every job for economy in production.

If labor costs are to be controlled, regardless of whether operators are working for an hourly wage or under a wage incentive plan, it is necessary to know how long it should take to do a given piece of work. The same method of establishing time standards should be employed for either hourly or incentive workers. Of course, in the case of hourly workers, one has no assurance of attaining standard production. Figure 2 shows what has been quite generally accepted by the engineering profession as performance of hourly and incentive workers.

In Fig. 2 the numbers on the line represent the average number of measured minutes of work produced by operators per hour. A measured minute is a time study minute (may be stop-watch time, or other, camera time, etc.) which has been adjusted to compensate for rating performance of operator, fatigue and personal need allowances. Under some incentive plans, sixty measured minutes of work per hour are set as standard, paid for at the base hourly rate of pay and each measured minute of work produced over and above standard is paid for at the same rate as standard production. The production of the normal operator on incentive will average around 80 measured minutes of work per hour. This compares with about 40 measured minutes of work usually produced by the normal operator working on an hourly rate basis.

From this chart it is readily seen that, in the case of hourly workers, there is no assurance of attaining standard production. To achieve a schedule of planned output from the worker, the help of a wage incentive plan will be necessary. Wage incentive plans based on sound principles and strictly adhered to by management will become increasingly important with the return of competitive business.

A step further toward controlled costs is a sound basic wage structure. Wages are the product of a money

and time factor. In the case of hourly work, the base or hourly rate of pay determines the money factor, and the produced measured minutes of work determines the time factor. For example, if the base hourly rate is $0.60/hr., that is a cent/minute. The hourly worker would receive $0.60 regardless of his productivity which might be only 40 measured minutes of work. However, the incentive worker would be expected to produce over 60 measured minutes of work per hour and thereby earn over $0.60 or a cent/minute. If his production is 80 measured minutes he will receive $0.80/hr.

Next, it is necessary to establish a basic wage structure, and the simplest method of doing this is with the aid of an occupational or job evaluation plan. An occupational or job evaluation plan establishes the relative value for every occupation in a foundry and serves as a foundation for all bargaining of wages for individuals or groups of individuals.

Without going into the detailed processes of evaluating the various occupations, it will suffice to state that all occupations in a plant will fall into one of the labor grades established by the evaluation. If merit rating of individuals is a part of the evaluation plan, then hourly workers may have a rate within the rate range for the labor grade into which their occupation places them.

Figure 3 illustrates the method of establishing the money factor or the conversion figure used in establishing wages for hourly workers or earned wages for incentive workers. This chart is divided into labor grades 3 to 17 inclusive. The plant in which this evaluation work was done did not have workers who fell below labor grade 3, therefore, 1 and 2 have been omitted. The base rate line, or A on the chart, is used for determining the conversion figure. It is the midpoint on this line in each labor grade that indicates the conversion figure for all work performed by individuals within this labor grade. This conversion figure for incentive work is not only a very important factor in cost control due to the fact that it establishes related conversion figures for various occupations, but it also becomes a very important factor in industrial relations.

Cost Control Defined

In offering the foregoing illustrations and examples, it was not intended to deviate from the original theme of foundry costs and cost controls. The author is convinced that the apparent lack of interest on the part of the foundry industry in following a plan to predetermine costs has been due in some measure to lack of information on how this might be accomplished. It was with this thought in mind that the author has sought to explain the function a cost control department might serve, as well as some of the basic steps of a good cost control system.

Perhaps the best definition of cost control is that given by Webster. He states that control is a matter of "directing influence over," "regulating" and "anything affording a standard of comparison or means of verifying." This definition may be applied to cost control.

It might well be said that a cost control department serves management through an assumption of the responsibility of directing, regulating and verifying costs through standards of comparison.

ALUMINUM CASTING*

THE SAND, permanent mold, and die casting of aluminum alloys involves all the elements of founding. While many of the practical aspects must be acquired through experience, a fundamental knowledge of alloys, techniques, materials and equipment will greatly assist the foundryman in producing economically a quality product.

The choice of alloys is important as they vary in castability, ease of handling, and susceptibility to the usual casting defects. They also must be considered in view of the application of the finished product as to mechanical properties, corrosion resistance, machinability, and surface finish.

The design of the casting will depend somewhat on the alloy and method of production, i.e., sand, permanent mold, or die cast. Other factors which must be considered in designing aluminum castings are draft, shrinkage, parting lines, coring, fillets, ribs, section thickness, and machine finish allowance.

Alloy Melting Practice

One of the most readily controlled variables, and at the same time one of the most frequently overlooked, is the alloy melting practice. Furnace equipment should be adequate and kept clean. Care must be taken to prevent the absorption of gases and the formation of oxides. These may be controlled by avoiding excessive holding times, overheating, and agitation of the metal. Fluxes may be used to clean the melt and to prevent excessive oxidation and gas absorption.

The gating of aluminum alloy castings is a part of the molding art, which to a great extent must be acquired by experience. Certain fundamental considerations and a knowledge of alloy characteristics serve as a guide, but the application of these to a particular casting is generally a matter of experience. Castings should be gated and fed in such a way as to provide a sequence of solidification which insures an adequate supply of molten metal to feed each section as it solidifies. Multiple gating is recommended. Proper design of gates and risers will reduce dross formation and shrinkage, and trapped gases which cause blows.

In the molding practice, consideration must be given to the characteristics of the alloy being cast, the type of mold, cores and chills if used, the rate of pour and the pouring temperature. If sand cast, the proper conditioning of the molding sand is essential.

Dross inclusions, shrinkage, porosity, and cracks are the principal defects to be avoided in the production of aluminum alloy castings. By the use of proper molding and metal handling practices, these defects can be eliminated or so minimized as to have no practical effect on the performance of the casting.

Care should be observed in handling the castings through the final processing to avoid damage. Warped castings may be straightened within limits. Castings may be repaired by welding if the application of the part is not critical.

* Abstracted from a paper of the same title presented at the Western Metals Congress, Oakland, Calif., by R. E. Paine, Aluminum Co. of America, Vernon Works, Los Angeles.

FOUNDRY COKE

Characteristics and Quality Factors

D. E. Krause
and
H. W. Lownie, Jr.
Battelle Memorial Institute
Columbus, Ohio

EFFICIENT UTILIZATION OF COKE in the cupola requires a knowledge of the characteristics of coke which have the greatest effect upon the economy and efficiency of cupola operation and upon the quality of the iron produced. At the present time, the foundryman has no practical laboratory tests by which he can reliably predict the behavior of various foundry cokes in his particular cupola practice. If such tests were available, they could serve as a basis for coke specifications and would enable cupola operators to make adjustments in practice to obtain maximum performance from cokes of different characteristics.

It is the purpose of this paper to review and summarize the published information on foundry coke, and to present test data which help to define the problem. These data were selected from tests conducted on foundry cokes in connection with cupola studies made by the Gray Iron Research Institute, Inc. It is believed that a critical summary will be of value to the cast iron industry in general. This summary is intended to stimulate thought on the problem of foundry coke, to prevent duplication of past efforts, to summarize lines of attack which have been fruitless in the past, and to indicate a new research method which may prove successful.

I. Conclusions

A review of the literature and supporting experimental studies indicate that, up to the present time, no suitable tests or combinations of them have been made available to foundrymen for predicting the behavior of foundry coke in any particular type of cupola operation. The problem is further complicated by the wide diversity of types of cupola operation. Laboratory tests have shown only limited and doubtful correlation with full-scale commercial operations. Of the various properties of coke tested to the present time, uniformity of size is reputed to be the most important factor controlling commercial operation. Coke strength seems to be the factor of next importance.

Conventional commercial cupola operation at its best is beset with many variables—coke being only one of them. These variables are so difficult to eliminate that it becomes an extremely difficult problem to adapt the performance of large commercial cupolas to the obtaining of reliable quantitative data which will permit prediction of the performance of various cokes when used in other commercial cupolas.

It seems reasonable to expect that a small cupola operated under rigorously controlled and standardized conditions can provide the necessary criteria for the qualitative comparison of the behavior of foundry cokes. However, the comparison of the behavior of such cokes in larger commercial cupolas under various conditions would still have to be ascertained. Although this may present a considerable task, hope is provided for the development of a test that can be reliably interpreted and which may provide the desired ability to predict coke performance in a cupola. A fresh start has been made in that direction. Figure 1 shows a 10-in. diameter cupola which has yielded highly reproducible performance over a considerable number of heats. The results obtained using this cupola as a tool for assessing coke performance will appear in future publications.

II. Review of Foundry Coke Literature

Chemical Abstracts was used as an index to publications on coke from 1936 to 1946. From approximately

Fig. 1—Experimental 10-in. cupola in operation.

Tapping Temperature	*2760 to 2820 F*
Coke Size	*1¼ x 1¾ in.*
Coke Ratio	*7½ to 1*
Air Rate	*11 to 12½ lb/min*
Melting Rate	*600 to 700 lb/hr*

1800 indexed publications on coke during this time, 158 were selected as bearing upon the performance of coke in the cupola. The selected articles, listed in the bibliography at the end of this paper, originated in fifteen countries as follows: England,41; United States, 38; Russia, 32; Germany, 25; France, 7; Japan, 4; Scotland, 2; India, 2; and one each from Belgium, Switzerland, Bulgaria, Poland, Italy, Rumania, and Brazil.

Scope of Literature Review

Some thought was given to the advisability of extending this review of the literature back beyond 1936. However, after a review of several of the major papers published between 1925 and 1935, it was concluded that most of the significant work done before 1936 has been included, summarized, or modified in later papers. The review from 1936 to 1946, inclusive, therefore, is believed to satisfy the requirement of a general picture of the present situation regarding foundry coke.

Each of the selected publications was abstracted and the general summary has been prepared according to the following outline:

A. Specifications
B. Usual Analytical and Test Methods
   1. Sampling
   2. Chemical Analysis
   3. Calorific Value
   4. Mechanical Strength
   5. Other Tests
C. Combustion and Combustion Tests
D. Reactivity and Reactivity Tests
E. Properties
   1. General Reviews
   2. Special Tests
F. Structure
G. Cupola Operation
   1. General Reviews
   2. Coke Size
   3. General Operation
H. Blast-Furnace Operation
I. Chemical Treatment
J. Production

A. Specifications

Standard specifications for foundry coke are limited to test methods, procedures, and nomenclature. The desirable range of properties is not indicated nor specified in any known standard specifications. There may be, however, some instances in which progressive individual plants or organizations have adopted unpublished specifications which specify particular properties.

Standard *test methods* are published by the American Society for Testing Materials to cover sampling procedures and several common tests.[1]

Standard Specification for Foundry Coke D 17-16 of the ASTM was written in 1916. This standard specified the following proximate analysis for foundry coke on a dry basis:

Volatile Matter	—	Not over 2.0 per cent
Fixed Carbon	—	Not under 86.0 per cent
Ash	—	Not over 12.0 per cent
Sulphur	—	Not over 1.0 per cent

The subcommittee charged with revision of this outdated specification reported in 1941[2] that the specification had outlived its usefulness, and that it was not possible at that time to prepare general foundry-coke specifications which would cover current operating practices. Accordingly, the specification was cancelled in 1941 and the subcommittee later disbanded. The ASTM is not carrying on any activities bearing on foundry-coke specifications at the present time.*

There are numerous statements throughout the literature deploring the lack of suitable consumers' specifications, but there are as yet no universally accepted standards for controlling and specifying foundry-coke quality. Each producer has his own methods for plant control of coke quality. Such individual control tests are often based upon the personal observations of a foundry engineer or sales engineeer employed by the coke producer.

The deficiency of acceptable consumers' standards is largely due to the fact that the interrelations of factors that make up coke quality are still undetermined. The determination of the properties of coke that affect commercial operation is prerequisite to the adoption of suitable standards.

B. Usual Analytical and Test Methods

1. *Sampling*—Sampling procedures and discussions found in the literature emphasize the necessity for obtaining accurate and representative samples of coke to be tested. The significance of subsequent tests depends upon the accuracy of the sample.

The procedures and precautions contained in ASTM Standard Method of Sampling Coke for Analysis D 346-35 for collecting the gross sample, crushing, mixing, and reduction are typical of various recommended practices and are regarded acceptable for general use.

All of the recommended sampling procedures are based upon obtaining large gross samples by the collection of a number of randomly selected increments. ASTM Method D 346-35 recommends that, for foundry coke, a minimum gross sample weight of 250 lb. be collected in not less than 25 nor more than 50 approximately equal random increments. This practice attempts to average out heterogeneity and variation in properties usually found within a single oven of coke.

Coke Sample Location

There is an excellent possibility that information of greater usefulness might be obtained by testing coke samples selected from certain specific locations within the oven. Such specific sampling from locations next to the oven wall and at the oven center is illustrated later in this review and has also been attempted on a limited scale by some producers. The difficulties attendant on such sampling, however, render it impractical for routine testing.

2. *Chemical Analysis*—The *proximate analysis* of coke consists of the determination of moisture, volatile matter, ash, and fixed carbon (by difference). *Ultimate analysis* consists of the determination of carbon and hydrogen as found in the gaseous products of complete combustion, the determination of sulphur, nitrogen, and ash in the material as a whole, and the estimation of oxygen by difference. The standard American procedures for determining both the proximate and ultimate analysis of coke are contained in ASTM Specification D 271-44. A number of foreign references suggest variations of the American methods.

*Private communication from Mr. A. C. Fieldner, Chairman, ASTM Committee D-5 on Coal and Coke.

When analyzing cokes for proximate analysis, it is necessary to adhere rigidly to the prescribed methods as the results obtained may be different if the procedures are altered. Minor variations in temperatures and times can appreciably alter the results. Until more refined methods are developed, it is advisable to adhere to the present ASTM methods so that the results obtained by different laboratories may be compared on the same basis.

Heating Value Determination

3. *Calorific Value*—The calorific or heating value of coke is determined quantitatively by the use of calorimeters. The actual determinations are rather laborious to make and require considerable precision. However, fairly good correlations have been worked out between the proximate analysis of cokes and their calorific value[24]. These correlations are sufficiently accurate for most purposes and, with few exceptions, may be used to eliminate the necessity for making the actual calorimetric tests.

4. *Mechanical Strength*—Many workers on the problem of coke quality feel that mechanical strength is the determining factor in coke quality. The usual tests for mechanical strength are the shatter test and the tumbler test. The shatter test is made by dropping sized coke through an appreciable distance under standardized conditions and measuring the degree of shatter due to the dropping. The tumbler test is made by rotating a standard sample of coke in a standard drum for a specific number of revolutions and measuring the degree of breakup. Standard methods for making both the shatter test and the tumbler test are specified by ASTM.[1]

The shatter and tumbler tests as specified by ASTM are not regarded as satisfactory for general use in testing foundry cokes. The shatter test was originally developed for testing blast-furnace coke. In the application of the test to foundry coke, some producers have developed variations of the test which use larger sample weights, larger coke before testing, and a more detailed screen analysis of the shattered coke.

The modifications of the shatter test vary from producer to producer, depending upon their individual experiences and the amount of thought which they have given to the problem. Variations of the tumbler test are also found, but this method is used in routine testing to a much less degree than the shatter-type test.

Specify Test Conditions

The ASTM shatter and tumbler tests both have the disadvantage of being arbitrarily applied to cokes of certain sizes only. However, the number of modifications of these tests is so great that the exact conditions of the test should be specified when results are reported. Other types of mechanical tests such as impact strength, grinding strength, and bending strength have also been applied to foundry coke, but none of them have yet been proven to be acceptable universally for the prediction of cupola performance under various conditions.

5. *Other Tests*—Tests for density, porosity, volume of cell space, true and apparent specific gravity, ash fusion temperature, and others are frequently applied in the routine testing of cokes. Most of these tests are included in ASTM specifications. Foreign workers use similar tests varying from ASTM tests in some details.

C. Combustion and Combustion Tests

Combustion is considered as the reaction of coke with air or oxygen. Combustibility is considered at the *rate* of reaction of coke with air or oxygen. There is no standard test procedure for determining the combustion characteristics or combustibility of coke, although numerous tests are proposed in the literature. Most of these are made on small laboratory samples which are heated in a stream of oxygen or air.

Combustion tests are usually designed to determine the ignition temperature of the coke under specific conditions. The ignition temperature changes as the conditions of the test are changed.

Combustibility is sometimes measured by continuously weighing a sample while burning under standardized conditions. The rate of loss of weight is used as a measure of the combustibility. Another method is to determine the rate of temperature rise while the sample is burning under standard conditions, and to use some function of the temperature rise as an index of the combustibility. This latter method is the one used in the Boegehold Combustibility Test[45].

Sample Size Variations

The major disadvantage of most combustion and combustibility tests is the small size of the sample used. The combustion characteristics of coke are greatly dependent upon particle size. The effect of particle size is so great that changes in the size of the coke pieces in the sample may affect the test results more than does the inherent combustibility of the coke. For this reason, combustion test results are difficult to correlate with commercial practice.

The most precise combustion and combustibility tests are rather complicated to perform. Variations in the size of the sample, particle size of the pieces in the sample, percentage of oxygen in the gas stream, gas-stream pressure, gas-stream velocity, rate of heating, and physical arrangement of the test apparatus all affect the test results.

For coke of a given size in a given test, the following factors have been credited with affecting combustion characteristics: particle size of the coal charge, coking time, coking temperature, coking rate, ash content, volatile-matter content, porosity, cell size, and degree of graphitization.

The literature shows no indication of a correlation between combustion characteristics as measured in a laboratory test and regular commercial operation. Combustion characteristics of the coke must undoubtedly affect commercial operation, but it is apparent that other factors in operation have considerably more effect than the measured combustibility. Therefore, combustibility tests by themselves are of doubtful value.

D. Reactivity and Reactivity Tests

Reactivity is defined as the rate of reaction of coke with carbon dioxide to form carbon monoxide. The reactivity of coke is important in cupola operation because the use of a highly reactive coke usually results in excessive formation of CO in the charge preheating

zone. Excessive CO not only usually results in lower melting-zone temperatures because of incomplete combustion, but it also results in high latent heat losses in the stack gas because of the presence of so much unburned CO.

With highly reactive coke, considerable coke is also lost by solution, i.e., by the reaction of coke with CO_2 to form CO. Therefore, coke ratios and thermal efficiencies are apt to be low when high-reactivity coke is used, and low-reactivity cokes in general would seem to be desirable for cupola melting.

Factors Affecting Test

Reactivity has been determined by a number of test methods. Essentially, all of them consist of passing CO_2 over coke heated to a definite temperature and determining the percentage of CO and CO_2 in the effluent gas. The actual test results vary with the temperature of the coke, temperature of the CO_2, pressure, CO_2 velocity, particle size of the sample, and other factors. Under given conditions, reactivity is affected by the same factors affecting combustion characteristics.

Reactivity tests are more difficult to perform than combustibility tests and are subject to the same disadvantages. As in the case of combustion tests, reactivity has not been satisfactorily correlated with actual operation. Other factors mask the effect of reactivity and make such correlation exceedingly difficult. Reactivity has received considerably more attention in gas-producing operations and blast-furnace practice than in cupola operations.

E. Properties

1. *General Reviews*—Thirteen general review articles on coke properties are listed in the bibliography. The first of these[73] is the most comprehensive single reference encountered in this review, although many of the coke properties shown are not representative of good-quality American coke.

A summary of these articles shows the following coke factors to be considered as the most important in affecting commercial operation. They are listed in order of apparent importance:

a. Uniformity of size
b. High strength and hardness
c. Low reactivity
d. Low ash and low sulphur

Size and strength taken together apparently constitute the best measure of coke quality known at present.

These review articles are generally unanimous in pointing out the failure of present methods of testing to evaluate the cupola operating characteristics of coke. Support is also given for the belief that coke quality can be best assessed by use of full or pilot-scale tests.

2. *Special Tests*—In addition to the usual tests listed under Usual Analytical and Test Methods, a number of special tests have been applied to coke in an effort to determine some property that would correlate with commercial operation. At the risk of repetition, but for the sake of completeness, the following list includes the *usual* and *special* tests most frequently encountered in the literature (see adjoining column).

As each of these tests has been made under numerous different conditions, each condition constituting a test in itself, it is apparent that considerable effort has been directed toward the solution of the problem. As none of the tests have yielded the desired results, it is interesting to note that all of them are laboratory tests. With the present background, therefore, it appears logical that laboratory testing should be augmented by other methods of testing, and that the results of such tests should be more carefully correlated with commercial operation.

It should also be pointed out that the suitability of coke for a certain type of cupola operation will probably involve the combination of several factors. Individual laboratory tests that have been used up to the present time apparently do not satisfactorily indicate the combined effect of these factors. Also, the relative importance of each property is not known. The solution of the problem will probably not be obtained by measuring properties independently. For a hypothetical example, let

S = coke strength
C = combustibility factor
k = empirical factor

After testing a number of cokes it might be found that $S \times C \times k$ equals a useful index of coke performance. S and C might vary independently of each other so that individual determinations of S and C would give little useful information, but a large number of combinations of S and C will give the same product.

F. Structure

A number of investigations have been made of the structure of coke, chiefly through the use of X-rays. The information obtained provides some fundamental back-

Usual Tests

Proximate analysis (moisture, volatile matter, ash, fixed carbon)
Ultimate analysis (C, H_2, O_2, S, N_2, ash)
Total moisture
Shatter test
Tumbler test
Apparent specific gravity
True specific gravity
Volume of cell space (porosity)
Bulk density
Ash fusion temperature
Composition of ash
Sieve analysis
Calorific value (heating value).

Special Tests

Combustibility and combustion
Reactivity
Electrical conductivity
Thermal conductivity
Specific heat
Permeability
Volatile therms
Luster, color, and reflectivity
Critical air blast
Microstructure
Macrostructure
Crystal structure (X-ray)
Selective flotation
Impact strength
Compressive strength
Elevated temperature strength
Wet oxidation.

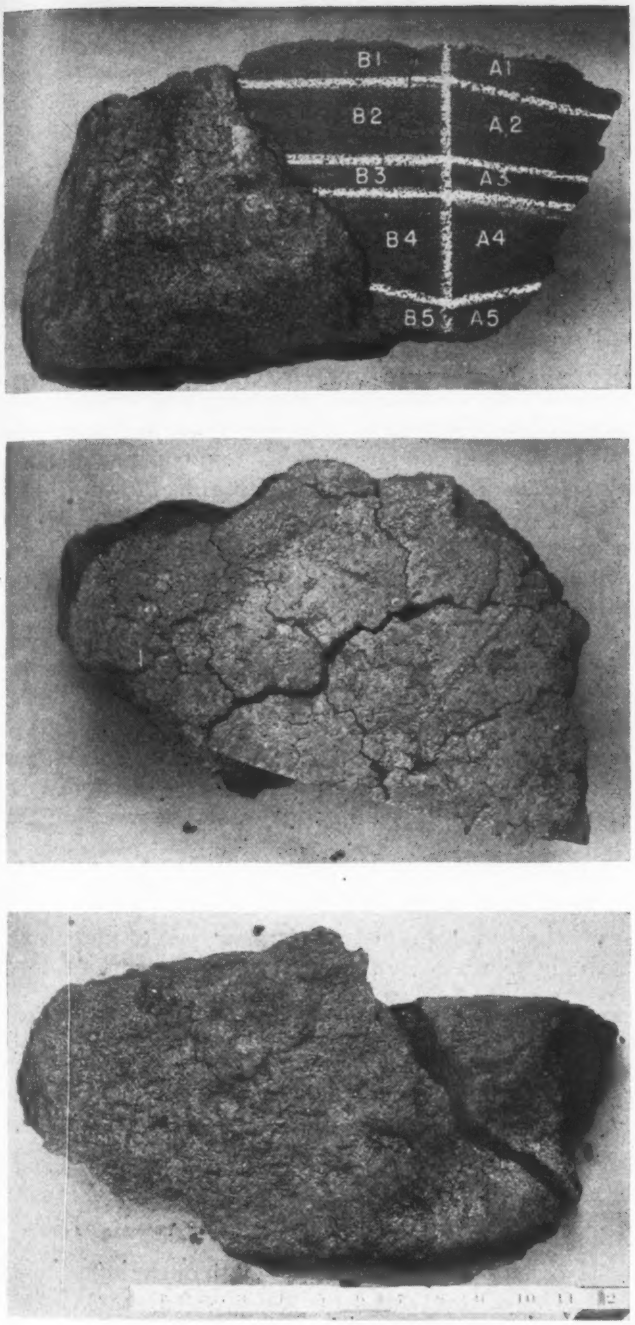


Fig. 2—Location of samples from lump of incompletely carbonized by-product coke showing differences in appearance from side adjacent to coke-oven wall to side at center of oven. Top, transverse view through oven. Oven wall is at top of photograph. Oven center is at bottom (against scale). Note darkening of coke towards oven center. Center, oven wall side. Saw cut at bottom shows location of slice taken for testing. Note fissuring, relatively smooth surface, and "cauliflower" appearance. Bottom, oven center side. Note dark, rough appearance of this coke specimen.

ground, but little has been developed that can as yet be applied to the solution of practical problems.

G. Cupola Operation

1. *General Reviews*—An English paper by O'Neil and Pearce in 1937[108] reported on a complete series of tests intended to correlate laboratory tests with performance in the cupola. It was concluded that none of the laboratory tests used were capable of predicting behavior in operation. Other papers report on the advisability of having coke of uniform size and suggest the use of baby cupolas for coke tests.[110]

2. *Coke Size*—The results of changing coke size are somewhat controversial. By using smaller coke, temperature is sometimes increased, sometimes lowered; melting rate is sometimes raised, sometimes lowered. Blast pressure generally increases with the use of smaller coke. Variations in the reported results of a number of independent tests from different sources are probably due to uncontrolled variables in cupola operation, differences in cupola construction, variations in charged materials, and nonuniformity of coke size. It is generally considered that the efficient operation of a given size of cupola requires the use of coke within certain limits of maximum and minimum size. Within these limits, it appears that the *uniformity* of coke size has more bearing upon operating results than the actual size itself.

3. *General Operation*—Several papers on the effects of coke ratio and blast volume upon the composition of the stack gases are not too enlightening, although an early paper (1913) by Belden[119] shows the gas composition and indicates the temperatures found in various parts of a coke bed under blast. Belden shows the presence of an inverted conical zone of max. temperature.

The ability of a cupola to melt iron under adverse conditions is shown by the fact that cupolas have been operated on anthracite, peat, charcoal, and wood.

As a general observation, various tests on cupola operation reported in the literature have paid very little attention to the quality of the coke being used.

H. Blast-Furnace Operation

The use of coke in blast furnaces has received considerably more attention than the use of coke in cupolas. Thirteen articles dealing with blast-furnace operation that have been included in this review show that the type of work being done in this field closely parallels that being done with respect to cupola operation. The problems in regard to blast-furnace operation are naturally somewhat different from those in cupola operations. Even so, the present conclusions regarding blast-furnace coke are very similar to those for cupola coke. Uniformity of size and high strength appear to be the two most desirable features. In each case reported, a change from unsized to sized coke resulted in improved furnace operation. Several papers conclude that actual use in a blast furnace is the only good measure of coke quality.

I. Chemical Treatment

The possibility of altering the properties of coke by chemical treatment has received considerable attention. Most of this activity has been directed toward increasing the reactivity of coke to be used in gas-producing reactions, gas absorption, and chemical processes other than combustion. For cupola coke, it is usually desired to go the other way and to reduce reactivity.

Salts of calcium, strontium, vanadium, zinc, manganese, lithium, barium, cadmium, chromium, copper, mercury, potassium, sodium, aluminum, silicon, iron,

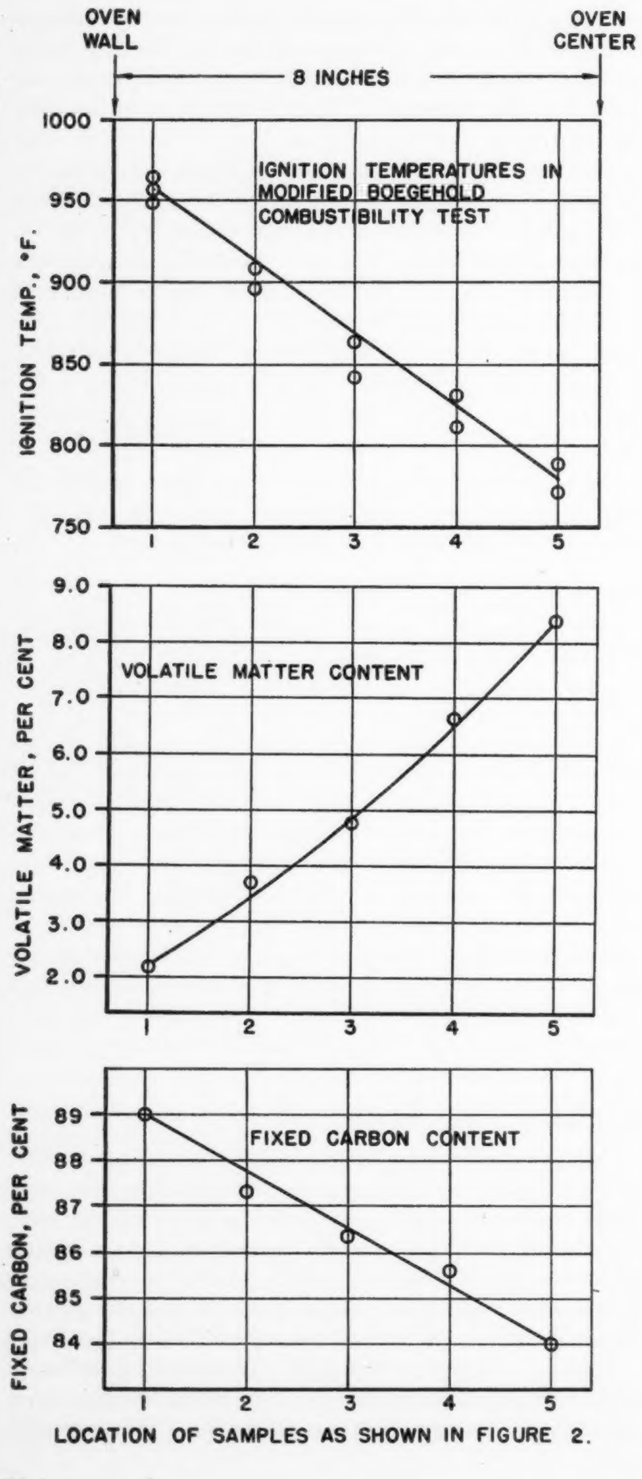
and probably others have been used for the chemical treatment of coke. The usual compounds are the oxides or hydroxides, carbonates, sulphates, chromates, dichromates, and chlorides. None of the treatments appear particularly promising for improving the operation of cupola coke.

Chemical additions have been made both to the blended coal before coking and to the finished coke by dipping or spraying. There are objections to both of these methods of treatment.

Chemical treatment has also been used to decrease the ash content of coke. Reductions in ash content from 17 to 7 per cent and from 6.45 to 0.70 per cent have been reported in some investigations.

Additions of lime and other fluxing agents to coal have been used to produce self-fluxing cokes which are said to cause less refractory loss in the cupola.

Fig. 3—Characteristics of selected pieces of by-product coke shown graphically.



J. Production

As this review is being made from the consumer's point of view, only a few papers were selected on the production of coke. The selected papers are included to indicate some of the methods that are being used in the production of coke to improve coke quality. Coal blending and coking practice are sometimes used as a basis of coke specification. Blending and coking practice undoubtedly have a major influence upon the performance of coke in a cupola, and continued efforts along these lines are definitely desirable. However, producers are handicapped in such work because of the necessity of using the coals which are economically available in a particular area. At the present time, producers rely heavily upon contacts with the consumers of their coke and attempt to work out correlations between some type of coke-plant control test and the results obtained in cupolas using their particular coke.

The dry quenching of coke with gases instead of wet quenching with water has received some attention, but has not been generally adopted. Coke quality may be appreciably improved in some cases by washing the coal before coking.

Most producers are regularly making tests to attempt to keep their products under control. However, such individual efforts aimed at uniformity of product from a single plant do not assure the uniformity of coke quality in the foundry industry as a whole.

III. Performance vs. Laboratory Tests

Several examples of tests on foundry cokes are given below to illustrate some of the difficulties encountered when present methods of testing are used to correlate coke properties with performance in the cupola.

A. Plant Survey

Two cupola heats were run at each of the 18 member foundries of the Gray Iron Research Institute. These heats were run on 12 different cokes or combinations of cokes. Cupola operating data and heat results were recorded as completely and as accurately as was possible in good commercial operation. The cokes were tested by determining the proximate analysis by ASTM methods, determining combustibility curves by a modification of the Boegehold combustibility test and, in some cases, by measuring other special properties.

Although certain trends were evident, the correlation between cupola performance and coke properties was generally unsatisfactory. That is, the correlations were unsatisfactory because they provided no dependable basis on which coke performance could be *predicted*. The lack of correlation might also be due to inadequate control over some of the variables or to the effect of variables which were not evaluated.

B. Selected Cokes

Over an extended period of operation, each of three different foundries was able to set aside two lots of coke

–one lot of which gave good cupola performance and one lot which yielded poor performance. The performance ratings were based upon general cupola operation and were made by the foundry personnel. The product of these foundries varied from piston rings in one to heavy machinery parts in another.

Laboratory tests for combustibility, proximate analysis, and true and apparent specific gravity, upon these three pairs of cokes, revealed no consistent differences between the *good* and *poor* cokes. None of these tests consistently *predicted* whether a coke should be rated as good or poor.

In evaluating tests made at different foundries, with different types of cupola operation or producing different products, considerable attention must be given to the fact that a coke that is considered good by one foundry may be considered poor in another type of operation. Such a divergence of opinion might mean either that the operation of one group of cupolas has not been adjusted to burn this particular coke properly or that the coke actually is not suitable to one of these types of operation. The determination of the effect of coke properties upon cupola operation must be made in such a manner that performance under *various accurately controlled* conditions of cupola operation can be predicted.

C. Dangers of Inadequate Sampling

During the plant survey mentioned above, cokes were sampled and tested according to ASTM recommended methods. With several cokes, however, a determination was made of the uniformity of coke properties from the coke-oven wall to the center of the oven. For one incompletely carbonized piece of coke (shown in Fig. 2), volatile-matter content increased from about 2.1 per cent at the oven wall to about 8.3 per cent at the oven center, as shown in Fig. 3. Ignition temperature in a combustion test varied from 960 F at the oven wall to 780 F at the oven center, and fixed carbon content varied from about 89 per cent at the oven wall to about 84 per cent at the center of the oven.

These variations within this one lump of coke were greater than the variations encountered between all the different cokes previously sampled by ASTM methods. This piece of coke is admittedly of very poor quality, but the fact remains that it was selected from a routine shipment of coke made to a commercial foundry.

In contrast to this piece of incompletely carbonized coke, Fig. 3 also shows the properties obtained across a section of high-quality coke that was sampled in the same manner. The properties shown in Fig. 3, therefore, illustrate the extreme conditions obtainable in a distance of about eight inches from oven wall to oven center, and emphasizes the sampling difficulties attendant upon coke testing.

Because of the magnitude of the variation in coke properties that may be encountered, accurate sampling is extremely important. Inadequate sampling practice can well account for some of the poor correlation between coke test data and cupola operations. When attempting to make such correlations, it is extremely important that (1) the true nature of the coke is quantitatively known, and (2) that the cupola operation is carefully controlled and quantitatively recorded.

Even assuming that accurate samples can be obtained, the values of data obtained on an average sample of widely differing components is likely to be misleading. The ignition temperature of a piece of coke depends more upon the maximum volatile-matter content in any part of that piece rather than upon the average volatile-matter content. Mere determination of an average value yields little useful information unless limits are also established. It is easy to imagine two cupola operations, one with tapping temperatures of 2680 to 2720 F and the other with temperatures from 2500 to 2850 F. Both might show an *average* of 2700 F, but there is little doubt that the first would represent better operation.

These difficulties involved in obtaining representative samples emphasize the unreliability of laboratory testing using small samples when the data are to be applied to commercial operations.

IV. Acknowledgment

The summary of the literature, bibliography, and all test data upon which this paper is based were selected from data developed by the Gray Iron Research Institute, Inc., as a part of its research program on foundry coke.

V. Bibliography

A. Specifications

1. ASTM Standards on Coke.

The Standards listed below may be obtained individually from the American Society for Testing Materials, may be referred to in the (1944) *ASTM Standards*, or may be obtained as a unit in *ASTM Standards on Coal and Coke (With Related Information)*, September, 1944.

D 346-35	"Sampling Coke for Analysis."
D 271-44	"Laboratory Sampling and Analysis of Coal and Coke"
D 167-24	"Test for Volume of Cell Space of Lump Coke"
D 141-23	"Drop Shatter Test for Coke"
D 294-29	"Tumbler Test for Coke"
D 293-29	"Test for Sieve Analysis for Coke"
D 292-29	"Test for Cubic Foot Weight of Coke"
D 547-41	"Test for Index of Dustiness of Coal and Coke"
E 11 -39	"Sieves for Testing Purposes"
D 121-30	"Terms Relating to Coal and Coke"
D 407-44	"Gross Calorific Value and Net Calorific Value of Fuels"

2. "Report of Subcommittee VIII (Committee D-5) on Foundry Coke Specifications," *ASTM Bulletin*, March (1941).

B. Usual Analytical and Test Methods

1. Sampling.

3. B. A. Landry, "Fundamentals of Coal Sampling," *U. S. Bur. Mines Bull. 454* (1944).

4. "Sampling and Analysis of Coal and Coke," British Standards Institution, London, S. W. 1, England, *British Specifications BS735* (Revised edition), (1944).

5. "Sampling and Analysis of Coal and Coke," American Standard K 18.1, (1944).

6. R. H. Powell, "Recent Developments in Laboratory Apparatus," *Iron and Steel*, vol. 16, p. 428 (1943).

7. Z. I. Badanova and L. Z. Leitman, "The Preparation of Coke Samples for Analysis," *Coke and Chem.* (U.S.S.R.), p. 54 (1939).

2. Chemical Analysis

8. F. S. Sinnatt, "Methods of Analysis of Coal and Coke," *Fuel*, vol. 19, p. 251 (1940).

9. Methods of Analysis of Coal and Coke, *Chemical Publishing Company*, New York (1941).

10. H. H. Lowry and C. O. Junge, "Statistical Study of the Precision of Methods for Analysis of Coal and Coke," ASTM Preprint No. 80 (1942).

11. Determination of Volatile Matter in Coal and Coke," *Fuel,* vol. 21, p. 102 (1942). Appendix to *British Standards* (1942).
12. I. A. Kopeliovich and M. K. Karpova, "Determination of Volatile Substances in Coke", *Khim. Referat. Zhur.,* vol. 6, p. 135 (1938).
13. A. P. Shakhno and M. D. Zhukovskaya, "Determination of Volatile Matter in Coke," *Zavodskaya Lab.,* vol. 4, p. 874 (1935).
14. A. C. Bose and N. N. Das Gupta, "Determination of Total Moisture in Coke," *Tisco Rev.,* vol. 9, p. 84 (1941).
15. R. Belcher and C. E. Spooner, "The Rapid Determination of Moisture and Ash in Coal and Coke," *Fuel,* vol. 23, p. 46 (1946).
16. A. Ya. Kistyan, "Determination of the Ash Content of Fuels by Combustion in a Current of Oxygen," *Chem. Zentr.,* p. 299 (1942).
17. "Midland Coke Research Committee, Report of Progress During 1941," *Fuel,* vol. 21, p. 94 (1942).
18. A. E. Beet and R. Belcher, "A Rapid Method for the Simultaneous Determination of Sulphur and Chlorine in Coal and Coke," *Fuel,* vol. 19, p. 42 (1940).
19. W. Mantel and W. Schreiber, "A Rapid Method for Determining Total Sulphur in Coal and Coke," *Gluckauf,* vol. 75, p. 929 (1939).
20. S. S. Tomkins, "Volumetric Determination of Sulphur in Coal and Coke," *Ind. Eng. Chem., Anal. Ed.,* vol. 14, p. 141 (1942).
21. L. Silverman, "Routine Determination of Sulphur and Phosphorus in Coke," *Ind. Eng. Chem., Anal. Ed.,* vol. 13, p. 524 (1941).
22. R. A. Mott and C. E. Spooner, "The Mineral Matter of Coal and Coke," *Fuel,* vol. 23, p. 9 (1944).
23. O. Niezoldi, "Possibilities of Error in the Examination of Hard Fuel," *Warme,* vol. 62, p. 31 (1939).

3. Calorific Value

24. H. Lefebvre and C. Georgiadis, "Evaluation of the Calorific Value of Coals and Cokes Without Calorimetric Measurements," *Chimie et industrie,* vol. 46, p. 147 (1941).
25. W. J. G. Davey, "Interpretation of Gas Works Analysis, IV," *Gas World,* vol. 118, p. 81 (1943).

4. Mechanical Strength

26. Ya. O. Gabinskii and Z. I. Badanova, "Testing the Mechanical Properties of Coke," *Coke and Chem.* (U.S.S.R.), vol. 8, p. 24 (1936).
27. A. A. Smolyanitskii, "Standardization of the Physical Properties of Metallurgical Coke," *Coke and Chem.* (U.S.S.R.), vol. 7, p. 15 (1937).
28. K. Bunte and H. Bruckner, "Friability of High-Temperature Coke," *Gas- u. Wasserfach,* vol. 82, p. 162 (1939).
29. E. Combles and W. Surmund, "Physical Testing of Cokes by Means of a 5-Kilogram Tumbler," *Chem. Zentr.,* p. 2267 (1943).
30. H. Richter, "Specifications for Tumbler Test of High-Temperature Coke," *Gluckauf,* vol. 75, p. 924 (1939).
31. H. R. Asbach and W. Brosse, "Laboratory Method for the Prediction of Coke Strength," *Chem. Zentr.,* p. 2266 (1943).
32. A. Thau, "The Resistance of Low-Temperature Coke to Degradation by Pressure, Shattering, and Abrasion, *Oel u. Kohle,* vol. 40, p. 55 (1944).
33. L. M. Sapozhnikov and K. I. Syskov, "New Principles and Methods for Evaluating the Physicomechanical Properties of Coke," *Zavodskaya Lab.,* vol. 9, p. 809 (1940).
34. P. A. Schukin, "New Method for the Evaluation of Metallurgical Coke," *Coke and Chem.* (U.S.S.R.), vol. 10, p. 6 (1940).
35. "Northern Coke Research Committee Annual Report No. 8, 1936," *Fuel,* vol. 16, p. 148 (1937).
36. Heinrich Macura, "Behavior of Bituminous Coals on Heating. V. The Relations Between Grinding Strength and Bending Strength of Coke," *Oel u. Kohle,* vol. 39, p. 113 (1943).

5. Other Tests

37. R. C. Smith and H. C. Howard, "Density and Porosity of Carbonaceous Materials," *Ind. Eng. Chem.,* vol. 34, p. 438 (1942).
38. J. Hiles and R. A. Mott. "Determination of the Real Specific Gravity of Coke," *Fuel,* vol. 16, p. 64 (1937).
39. D. A. Reynolds, "Relationship of Ash-Fusion Temperatures of Coal and Coke," *U. S. Bur. Mines, Report of Investigations No. 3035* (1940.

C. Combustion and Combustion Tests

40. J. Hiles and R. A. Mott, "The Mode of Combustion of Coke," *Fuel,* vol. 23, p. 154 (1944).
41. John Roberts, "The Combustion of Carbon," *Coke Smokeless-Fuel Age,* vol. 6, p. 211 (1944).
42. H. M. Finiston, "The Combustibility of Coke," *J. West. Scot. Iron Steel Inst.,* vol. 47, p. 15 (1939).
43. H. M. Finiston, "Coke Formation and Coke Combustibility," *J. Roy. Tech. Coll.* (Glasgow), vol. 4, p. 671 (1940).
44. M. A. Mayers, "Combustion Characteristics of Coke," *Carnegie Inst. Tech. Coal Research Lab. Contrib. 97,* (1942).
45. A. L. Boegehold, "Quality of Pig Iron and Castings as Affected by Blast Furnace Practice," Transactions, American Foundrymen's Association, vol. 37, p. 148 (1929).
46. R. E. Zane and H. F. Yancey, "Combustibility of Coke in Air, a Laboratory Method," *U. S. Bur. Mines Report of Investigations No. 3499* (1940).
47. E. Orosco, "New Method for Measuring the Velocity of Combustion of Coke," *Anais assoc. quim. Brasil,* vol. 3, p. 197 (1944).
48. R. A. Sherman, J. M. Pilcher, and H. N. Ostborg, "A Laboratory Test for the Ignitibility of Coke," *ASTM Preprint No. 96* (1941).
49. W. S. Brown and J. H. Jones. "Determination of the Ignition Temperature of Coke," *J. Soc. Chem. Ind.,* vol. 55, p. 81 (1936).
50. Schroth, "New Apparatus for Determining the Ignition Point of Coke," *Gas u. Wasserfach,* vol. 81, p. 259 (1938).
51. C. R. Holmes and J. D. Davis, "Kindling Properties of Coke," *Ind. Eng. Chem.* vol. 28, p. 484 (1936).
52. "Coke Quality, I. Sizing of Coke," Report of the Institution of Gas Engineers' Committee of Inquiry. *Gas. J.* vol. 240, p. 98 (1942).
53. J. Hiles and R. A. Mott, "The Effect of Particle Size on the Combustion Reactions in a Bed of Coke," *Fuel,* vol. 23, p. 134 (1944).
54. I. F. G. McVicker and R. M. Baic, "Combustion Data for Coke, *Coke Smokeless-Fuel Age,* vol. 3, p. 231 (1941).
55. A. L. Nicolai, "Combustion Calculations by Graphical Methods, VI. Coke and Coke Breeze," *Combustion,* vol. 13, p. 32 (1942).
56. K. G. Skinner, "Coke-Carbon Dioxide Relations," *Ind. Eng. Chem.,* vol. 29, p. 696 (1937).
57. W. Schairer, "Physical Methods for Evaluating Coke," *Gas u. Wasserfach,* vol. 80, p. 422 (1937).
58. D. J. W. Kreulen, "Practical Conditions of Coke Utilization: Combustibility, Fusibility of Ash," *15me Cong. chim. ind.* (Bruxelles, Sept., 1935), p. 682 (1936).
59. A. S. Bruk, "Rapidity of Lump Coke Combustion," *Coke and Chem.* (U.S.S.R.), p. 18 (1936).
60. R. Durrer, P. Lwowycz, and B. Marcinek, "The Combustion of Coke with Oxygen-Rich Blast and Its Effect on Melting," *Arch. Eisenhuttenw.,* vol. 16, p. 329 (1943).
61. A. A. Orning, "The Reactivity of Solid Fuels," *Ind. Eng. Chem.,* vol. 36, p. 813 (1944).
62. M. K. Venstrem, "Combustion of Coke," *J. Tech. Phys.* (U.S.S.R.), vol. 9, p. 1592 (1939).

D. Reactivity and Reactivity Tests

63. A. Jarzynski and A. Klukowski, "Reactivity of Coke," *Przeglad Gorniczo-Hutniczy,* vol. 31, p. 296 (1939).
64. G. M. Isarov, "Reactivity of Lump Coke," *Coke and Chem.* (U.S.S.R), vol. 11, p. 25 (1941).
65. P. Dombrovski, "The Reactivity of Coke," *Plyn, Voda zdravotni Tech.,* vol. 16, p. 120 (1936).
66. D. A. Reynolds and J. D. Davis, "Reactivity of Coke—Improved Method for Determining the Reactivity of Coke in Carbon Dioxide," *Ind. Eng. Chem. Anal. Ed.,* vol. 8, p. 33 (1936).
67. M. A. Mayers, "Methods of Determining the Reactivity of Cokes," *Carnegie Inst. Tech. Coal Research Lab. Contrib. 36* (1936).
68. I. G. Petrenko, "Determination of the Reactivity of Coke," *Coke and Chem.* (U.S.S.R.), vol. 6, p. 61 (1936).
69. R. Heinze and H. Farnow, "Reactivity of Brown-Coal Cokes," *Braunkohle,* vol. 36, p. 277 (1937).
70. D. Swarup and P. Mazumdar, "Reactivity of Indian Cokes," *Quart. J. Geol., Mining Met. Soc. India,* vol. 13, p. 169 (1941).
71. K. Hoehne, "Determination of the Reactivity of Coke," *Gluckauf,* vol. 79, p. 166 (1943).
72. H. Cassan, "Experimental Study of the Reactivity of Various Kinds of Carbon with Respect to Water Vapor and to Carbon Dioxide," *Chaleur et ind.,* vol. 18, p. 355 (1937).

E. Properties

1. General Reviews

73. R. A. Mott and R. V. Wheeler, Quality of Coke. Second Report of Midland Coke Research Committee, Iron and Steel Industrial Research Council, Chapman and Hall, Ltd., London. (1939).

74. *Chemistry of Coal Utilization.* John Wiley and Sons, New York (1945). p. 863—"*Physical Properties and Reactivity of Coke.*"
75. B. P. Mulchay, "Foundry Coke: A Critical Study," TRANSACTIONS, American Foundrymen's Association, vol. 52, p. 819 (1945).
76. H. H. Lowry and M. A. Mayers, "Properties of Blast-Furnace Cokes," *Iron Steel Engr.*, vol. 20, p. 36 (1943).
77. B. P. Mulcahy, "Foundry Coke Specifications," AMERICAN FOUNDRYMAN, vol. 2, p. 5 (1940).
78. G. O. Issarov, "Determining the Quality of Coke," *Coke and Chem.* (U.S.S.R.), vol. 7, p. 38 (1937).
79. B. P. Mulcahy, "Foundry Coke. An Interpretive Discussion," *Fuel,* vol. 18, p. 100 (1939).
80. Joseph Brown, "Assay of Coal for Carbonization Purposes," *Inst. Fuel Wartime Bulletin,* p. 41, Dec. 1944.
81. R. Lefebvre and J. Lefebvre, "Characteristics of a Good Foundry Coke," *Metallurgie construct. mecan.*, vol. 69, p. 17 (1937).
82. E. C. Evans and J. M. Ridgeon, "Work of the Coke Research Committees of the Iron and Steel Industrial Research Council," *Iron Steel Inst.* (London), *Special Report No. 17,* (1937).
83. W. E. Mordecai, "Foundry Coke," *Colliery Guardian,* vol. 151, p. 1079 (1935). (Also *Gas World*), vol. 104, p. 3 (1936).
84. W. Demann, "Qualities of Fresh Versus Stored Cokes," *Tech. Mitt Krupp,* vol. 4, p. 17 (1936).

2. Special Tests

85. "Northern Coke Research Committee Annual Report for 1937," *Fuel,* vol. 17, p. 172 (1938).
86. Ya. O. Gabinskii, E. S. Krym, and R. A. Treigerman, *Khim. Tverdogo Topliva,* vol. 7, p. 441 (1936).
87. J. D. Davis and A. C. Fieldner, "Relation of Carbonizing Temperature and Rank of Coal to the Reactivity, Electrical Conductivity, and Hygroscopicity of Coke," *Am. Gas Assoc. Proc.*, vol. 17, p. 636 (1935).
88. S. Khitrik and Ya. Tsybakin, "Electrical Resistance of the Charge Used in Making Ferrosilicon," *Teoriya i Prakt. Met.*, vol. 10, p. 23 (1938).
89. B. V. Mints, "Electrical Conductivity of Carbon Materials in Relation to temperature," *Tsvetnye Metal.*, p. 65 (1940).
90. A. S. Bruk and M. V. Afanasev, "Connection Between Electrical Conductivity and Quality of Coke," *Coke and Chem.* (U.S.S.R), p. 31 (1936).
91. W. Fritz and H. Diemke, "The Thermal Conductivity of Coal and Coke," *Feuerungstech.*, vol. 27, p. 129 (1939).
92. Walter Fritz, "A General Survey of the Heat- and Thermal-Conductivity of Coal," *Forsch. Gebiete Ingenieurw.*, vol. 14, p. 1 (1943).
93. W. Fritz and H. Kneese, "Thermal Conductivity, Specific Heat, and Thermal Conductivity of Coke and Lignite," *Feuerungstech.*, vol. 30, p. 273 (1942).
94. W. Brewin and R. A. Mott, "The Permeability of Coke," *Fuel* vol. 23, p. 90 (1944).
95. I. J. Lane, "A Simple Apparatus for the Estimation of Volatile Therms in Coke," *Chemistry and Industry,* p. 488 (1936).
96. L. M. Sapozhnikov and K. I. Syskov, "Luster, Color, and Reflecting Properties of Cokes," *Coke and Chem.* (U.S.S.R.), p. 3 (1939).
97. W. Brewin and J. K. Thompson, "The Critical Air Blast Test and Its Significance," *Fuel,* vol. 16, p. 361 (1937).
98. P. J. Askey and S. M. Doble, "Note on the Critical Air Blast Test," *Ibid,* p. 359 (1937).
99. I. O. Cabinskii and C. M. Issarov, "Effect of High Temperature on Coke," *Coke and Chem.* (U.S.S.R.), vol. 6, p. 56 (1936).
100. G. Wilde, "Change in the Properties of Coke by Heating to High Temperatures," *Mitt. Kohle- u. Eisenforsch.*, vol. 2, p. 109 (1939).
101. G. M. Isarov, "Behavior of Coke at High Temperatures," *Coke and Chem.* (U.S.S.R.), vol. 9, p. 13 (1939).

F. STRUCTURE

102. Louis Shnidman, "Ash Structure in Coke," *Ind. Eng. Chem.*, vol. 35, p. 126 (1943).
103. G. Milner, E. Spivey, and J. W. Cobb, The Solid Product of Carbonization," *J. Chem. Soc.*, p. 587 (1943).
104. J. Gibson and H. L. Riley, "The Crystal Chemistry of Carbonization," *Fuel,* vol. 21, p. 36 (1942).
105. V. I. Danilov, M. A. Levachevich, and I. Z. Olifirenko, "X-ray Examination of the Fissuring of Coke," *Coke and Chem.* (U.S.S.R.), vol. 9, p. 50 (1939).
106. D. I. Dechalit and N. M. Prosvirnina, "Graphitic Carbon and Amorphous Carbon in Coke," *Coke and Chem.*, (U.S.S.R.), vol. 6, p. 9 (1936).
107. H. Landmann, "Formation of the Exterior and Interior Surfaces of Coke," *Arch. Eisenhuttenw.*, vol. 10, p. 1 (1936).

G. CUPOLA OPERATION

1. General Reviews

108. H. O'Neill and J. G. Pearce, "Foundry and Laboratory Characteristics of Cupola Cokes," *Proc. Inst. Brit. Foundrymen Preprint No. 609,* (1937).
109. B. P. Mulcahy, "Coke Properties and Cupola Melting. I, II," *Foundry,* vol. 72, No. 10 and No. 11 (1944).
110. H. W. Gillett, "Cupola Raw Materials," TRANSACTIONS, American Foundrymen's Association, vol. 52, pp. 1-15 (1944).

2. Coke Size

111. R. A. Mott and R. V. Wheeler, "The Effect of the Size of Coke on Its Combustion," *Symposium on Combustion of Solid Fuels, Amer. Chem. Soc., Boston,* p. 95, Sept. 12 (1939).
112. S. O. Birulya, "Importance of Coke Size in Melting Pig Iron in the Cupola, *Liteinoe Delo,* vol. 9, p. 14 (1938).
113. R. C. Tucker, "Cupola Operation and Control," *Fdry. Trade J.*, vol. 72, p. 135 (1944).
114. G. Buzek and M. Czyzewski, "Influence of Coke Size on the Heat Loss of Iron During Melting in the Cupola," *Bull. assoc. tech. fonderie,* vol. 12, p. 264 (1938).
115. G. Spechhardt, "Behavior of Coke in the Cupola," *Giesserei,* vol. 25, p. 55.
116. J. A. Bowers and J. T. MacKenzie, "Cast Iron as Affected by Coke Size in Cupola Melting," TRANSACTIONS, American Foundrymen's Association, vol. 45, p. 293 (1937).

3. Cupola Operation

117. H. E. Blayden, W. Noble, and H. L. Riley, "Some Experiments in a Small-Scale Cupola," *Foundry Trade J.*, vol. 57, p. 261 (1937).
118. M. Dudonet, "Cupola Operation," *Bull. assoc. tech. fonderie,* vol. 12, p. 78 (1938).
119. A. W. Belden, "Foundry Cupola Gases and Their Temperatures," *U. S. Bur. Mines Bull. No. 45* (1913).
120. H. Jungbluth and E. Bruhl, "Relationship Between Coke Charge and Composition of Waste Gases in Cupolas," *Tech. Mitt. Krupp Forschungsber,* vol. 2, p. 1 (1939).
121. "Midland Coke Research Committee Report of Progress During 1942," *Gas World,* vol. 119; No. 3079, p. 100; No. 3083, p. 123 (1943).
121. Marcel Bader, "Melting in Hot-Blast Cupolas," *Giesserei,* vol. 30 (1943).
123. N. Zharikov, "Melting of Cast Iron in the Cupola With Coal Instead of Coke," *Liteinoe Delo,* vol. 12, p. 14 (1941).
124. M. S. Sadovnikov, "Melting of Cast Iron in the Cupola With Mixtures of Peat, Coke, and Anthracite," *Liteinoe Delo,* vol. 12, p. 33 (1941).

H. BLAST-FURNACE OPERATION

125. H. W. Johnson, "Correlations of Some Coke Properties With Blast-Furnace Operation," *AIMME, Tech. Pub. No. 1402* (1941).
126. P. A. Shchukin, "The Problem of Changing Over Blast Furnace to Operate on Classified Coke," *Stal,* vol. 3, p. 3 (1943).
127. T. P. Colclough, "Considerations of Blast Furance Practice," *J. Iron Steel Inst.* (London), October, 1944.
128. K. Neustaetter, "Gas Flow and Coke Consumption in the Blast Furnace, *Blast Furnace Steel Plant,* vol. 33, p. 825 (1945).
129. Theodore Powell, "The Blast Furnace Burden," *Metallurgia,* vol. 32, p. 121 (1945).
130. C. C. Russell and M. Perch, "Some Physical Characteristics of By-Product Coke for Blast Furnaces," *AIMME Tech. Pub. No. 1520* (1942).
131. Y. Yasuda, "The Quality of Blast Furnace Coke," *J. Fuel Soc. Japan,* vol. 20, p. 13 (1940) (In English).
132. M. A. Mayers, "Some Functions of Coke in Blast Furnaces," *Blast Furnace Steel Plant,* vol. 29, p. 705 (1941).
133. L. D. Schmidt, W. C. Schroeder, and A. C. Fieldner, "Increased Pig Iron Output Through Improved Coke," *U. S. Bur. Mines Rept. Investigations 3711,* (1943).
134. C. G. Thibault, "Study of Blast Furnace Coke," *Rev. met.*, vol. 40, p. 129 (1943).
135. R. J. Barritt, "Metallurgical Coke, *Metallurgia,* vol. 28, p. 267 (1943).

136. L. M. Sapozhnikov, "The Mechanical Strength of Blast Furnace Coke," *Stal*, p. 3 (1941).

137. S. K. Trekalo and G. A. Volovik, "Effects of the Mechanical Properties of Coke on Blast Furnace Operation," *Coke and Chem.* (U.S.S.R) vol. 9, p. 45 (1939).

I. Chemical Treatment

138. P. J. Askey, "Alkali Activation of Coke," *Gas World*, vol. 124; No. 3205, p. 3; No. 3209, p. 13 (1946).

139. J. R. Arthur and K. D. Wadsworth, "The Effect of Inorganic Compounds on the Behavior of Coals and Cokes," *Brit. Coal Utilization Research Assoc. Bull.* vol. 8, p. 296 (1944).

140. R. N. Golovatyi, "The Effect of Ash Components on the Reactivity of Coke," *J. Applied Chem.* (U.S.S.R.), vol. 12, p. 1178 (1939).

141. G. E. Foxwell, "Chemical Activation of Coke," *J. Inst. Fuel*, vol. 10, p. 287 (1937).

142. P. Nicholls, "Chemical Treatment of Coal and Coke," *AIMME Tech. Pub. No. 848* (1937).

P. Nicholls and others, "Burning of Coal and Coke Treated With Small Quantities of Chemicals," *Bur. Mines Bull. No. 404* (1937).

143. O. Dony-Henault, "The Chemical Purification of Coke and Some Related Problems," *Chimie et industrie*, vol. 39, p. 225 (1938).

144. W. Demann and J. R. Schonmuller, "Research for Preparing Ash-Free Coal and Coke," *Gluckauf*, vol. 76, p. 112 (1940).

145. Kaoru Kitaoka, "Chlorine Treatment for Cokes at Red Heat," *J. Chem. Soc. Japan*, vol. 62, p. 96 (1941).

146. G. Henon, "Self-Fluxing Foundry Coke," *Foundry Trade J.*, vol. 57, p. 267 (1937).

147. V. M. Shestopal, "Self-Slagging Coke," *Vestnik Inzhenerov Tekh.*, p. 295 (1938).

148. I. Trifonov and M. Kurchatov, "Coking of Coal With the Addition of Portland Cement," *Ann. univ. Sofie*, vol. 35, p. 249 (1938-1939).

149. T. A. Tomlinson, "Coke Grading," *Gas World*, vol. 120, p. 520 (1944).

150. I. M. Roberts, "Increasing the Percentage Production of Large-Size Coke at Fast Coking Rates," *AIME Publ. 1612* (1943).

151. Wm. Masterson, "Coke-Grading Tables," *Gas World*, vol. 110, Annual Coal and Coke Handling Suppl. No. 24, (1939).

152. E. J. Tournier, "Materials Handling in the Progressive South. H. Coke Plants and Furnaces," *Southern Power and Ind.*, vol. 57, p. 56 (1939).

153. V. Bezhanishvili, "The Properties of Dry-Quenched Coke," *Stal*, vol. 9, p. 18 (1939).

154. J. Roberts, "The Quality of Coke," *Coke Smokeless-Fuel Age*, vol. 4, p. 86 (1942).

MAP FINANCIAL PLANS FOR FOUNDATION

The Foundry Educational Foundation held its first Annual meeting in Cleveland, May 8 at which time four new trustees and a complete set of officers were elected. The American Foundrymen's Association, Gray Iron Founders Society and Malleable Founders Society added the Foundry Equipment Manufacturers Association as a founding member of the foundation.

Officers selected to serve were as follows: President, Anthony Haswell, Dayton Malleable Iron Co., Dayton, Ohio; Vice-President, P. E. Rentschler, Hamilton Foundry & Machine Co., Hamilton, Ohio; Secretary, James H. Lansing, Malleable Founders Society, Cleveland; Treasurer, W. M. Caldwell, Gray Iron Founders Society, Cleveland; and Trustees, B. D. Claffey, General Aluminum & Gray Iron Foundry, Waukesha, Wis.; R. W. Crannell, Lehigh Foundries Inc., Easton, Pa.; Anthony Haswell; John M. Price, Ferro Machine & Foundry Co., Cleveland; P. E. Rentschler; F. G. Sefing, International Nickel Co., New York; Jas. S. Smith, Central Foundry Div., General Motors Corp., Saginaw, Mich.; S. C. Wasson, National Malleable & Steel Castings Co., Cicero, Ill.; Jas T. MacKenzie, American Cast Iron Pipe Co., Birmingham; B. L. Simpson, National Engineering Co., Chicago; George Hutchins, Standard Foundry Co., Worcester, Mass.; and O. A. Pfaff, American Wheelabrator & Equipment Co., Mishawaka, Ind.

As it was announced at the A.F.A. Annual Business Meeting in Detroit by Trustee B. D. Claffey, the Foundry Educational Foundation drive for $280,000 is under way. The fund is to be used to inaugurate special foundry training courses at five American engineering colleges in September, and to establish fifty scholarships at these universities and colleges.

Trustee John M. Price, Campaign Chairman, has appointed over fifty individuals affiliated with the castings industry to serve as regional co-chairmen to aid in raising the necessary fund.

Shown below are the regional co-chairmen appointed by Mr. Price to help carry out the Foundation's financial plans: C. S. Humphrey, C. S. Humphrey Co., Moline, Ill.; Duncan P. Forbes, Gunite Foundries Corp., Rockford, Ill.; John A. Wagner, Wagner Malleable Iron Co., Decatur, Ill.; Frank W. Shipley, Caterpillar Tractor Co., Peoria, Ill.; Leon J. Wise, Chicago Malleable Castings Co., Chicago; Edwin W. Horlebein, Gibson & Kirk Co., Baltimore; H. L. Edinger, Barnett Foundry & Machine Co., Irvington, N. J.; F. H. Rayfield, Potter & Rayfield Inc., Atlanta, Ga.; B. D. Claffey; B. G. Parker, Youngstown Foundry & Machine Co., Youngstown, Ohio; Henry S. Washburn, Plainville Casting Co., Plainville, Conn.; E. N. Harrison, Harrison-Corry Co., Knoxville, Tenn.; F. G. Sefing; J. W. Silver, Ogden Iron Works Co., Ogden, Utah; A. F. Fries, Peru Foundry Co., Peru, Ind.; R. H. Bancroft, Perfect Circle Co., New Castle, Ind.

J. A. Luby, Gartland Foundry Co., Terre Haute, Ind.; E. A. Herr, Servel Inc., Evansville, Ind.; Frank S. O'Neil, Link-Belt Co., Indianapolis; J. E. McIntyre, Sibley Machine & Foundry Corp., South Bend, Ind.; Edward A. Walda, Central Foundry Co., Ft. Wayne, Ind.; J. H. Young, Centre Foundry & Machine Co., Wheeling, W. Va.; Elliott F. Metcalf, Westmoreland Malleable Iron Co., Westmoreland, N. Y.; J. H. Pohlman, Pohlman Foundry Co., Buffalo; Gregory Brunk, Headford Brothers & Hitchins Foundry Co., Waterloo, Iowa; Robert Ward, American Car & Foundry Co., Huntington, W. Va.; Ray J. Redmond, Buckeye Foundry Co., Cincinnati; Herman P. Good, Textile Machine Works, Reading, Pa.; A. W. Schlegel, Ideal Pattern Works, St. Bernard, Ohio.

E. M. Francy, Toronto Foundry & Machine Co., Toronto, Ohio; George E. Bean, Eastern Malleable Iron Co., Wilmington, Del.; George F. Hutchins, Standard Foundry Co., Worcester, Mass.; R. E. Kucher, Olympic Foundry Co., Seattle; Carl F. LaMarche, American Malleable Casting Co., Marion, Ohio; E. C. Hoenicke, Eaton Mfg. Co., Foundry Division, Detroit; R. W. Crannell; C. R. Culling, Carondelet Foundry Co., St. Louis; Anthony Haswell; P. E. Rentschler.

COLLEGE FOUNDRY COURSES

Subcommittee on College Foundry Courses
Educational Division of A.F.A.

INTEREST IN IMPROVED AND EXPANDED foundry courses shown by engineering colleges increased with the close of the war. Although this interest developed during the war, concurrently with recognition of the importance of castings to a world at war, as well as in peace, it was not until recently that engineering colleges had a sufficient number of civilian students to warrant changing their curricula and altering their foundry courses.

Anticipating the need of and the desire for industrial cooperation on the part of engineering colleges, more than a year ago the Subcommittee on College Foundry Courses of A.F.A. inaugurated a broad program of study of the treatment of foundry practice by engineering colleges. Part of this study is presented in this report, which includes suggestions for proper emphasis on casting design in machine design courses, an outline for a freshman or sophomore course in foundry technology, and recommends an advanced course in foundry control methods.

Committee Personnel

The Subcommittee on College Foundry Courses, attached to the former Committee on Cooperation with Engineering Schools, consisted, at the time this report was prepared, of P. E. Kyle, associate professor of mechanical engineering, Massachusetts Institute of Technology (now professor of metallurgy, Cornell University), chairman; W. M. Ball, Jr., superintendent, Magnus Brass Div., National Lead Co.; G. J. Barker, chairman, department of metallurgy, University of Wisconsin; R. R. Deas, Jr., assistant to vice-president, American Cast Iron Pipe Co. (now foundry engineer, Lester B. Knight & Associates) and Dr. R. W. Lindsay, assistant professor of metallurgy, Pennsylvania State College.

The Subcommittee on College Foundry Courses is continuing its work as part of the newly formed Educational Division of the American Foundrymen's Association, which combines and coordinates all the educational and personnel training committees.

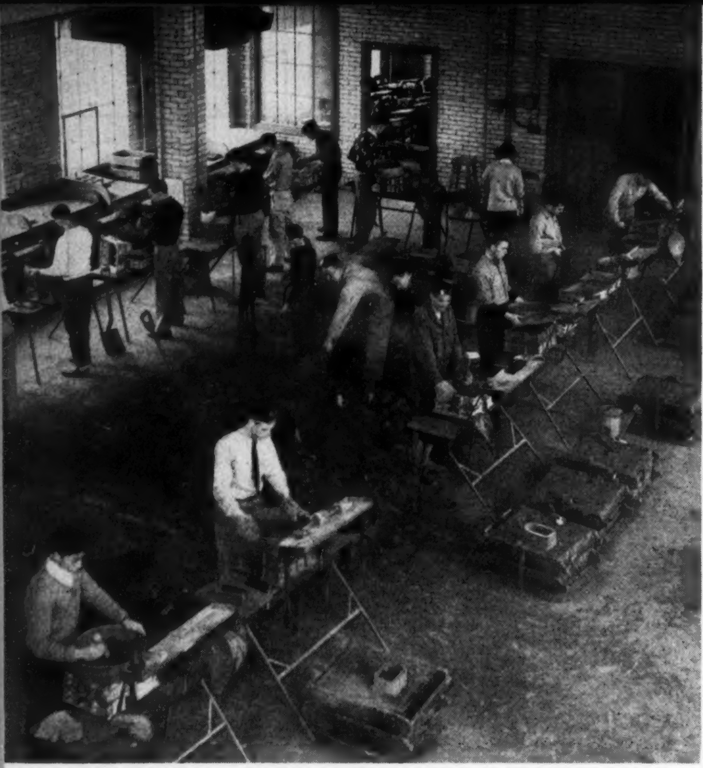
It is rather difficult to recommend an exact procedure to follow in treating the design and use of castings in courses in machine design because the subject must be spread throughout discussions of many machine elements such as frames, gears, levers, shafts, etc. In discussing components of machines, the duty of the instructor is to be impartial in his views toward the superiority or inferiority of castings, forgings, stampings, powder metallurgy and weldments.

If this attitude is adopted, the A.F.A. College Foundry Courses Subcommittee can help in two ways: (1) by seeing that textbooks include proper and up-to-date information on the properties and uses of castings; (2) by encouraging professors teaching foundry courses to cooperate with their own departments of machine design so that the material covered in foundry courses will be used effectively.

Members of the subcommittee have arranged with the principal publishers to review books already in use with the thought that their suggestions will be considered by the authors when the books are revised. It is also expected that manuscripts for new books in the field of machine design, processing, materials and metallurgy will be submitted to the subcommittee for review and comment.

Cooperation between the machine design department and the foundry laboratory staff is a matter which must be handled according to the personalities of the people involved as well as the actual arrangement of courses in the curriculum. One of the most effective ways to achieve cooperation is to have the student so well trained in casting practice and design that machine design professors are obliged to treat the subject according to the most up-to-date knowledge available. Another effective way is to have the professors sit in on each other's courses.

Foundry students transferring metal for hand pouring.



Foundry course students—a class in bench molding.

The course outlined in the following is suggested for a short course in foundry technology for freshman or sophomore college students. Prepared for the Subcommittee on College Foundry Courses by Professor G. J. Barker, chairman, Department of Metallurgy, University of Wisconsin, this course is recommended for all mechanical and metallurgical engineers. The course might well be required of all engineering college students.

Based on 14 one-hour lectures, two one-hour quizzes and 16 two-hour laboratory periods, the course outlined requires foundry laboratory facilities. The equipment needed can be determined in a general way from descriptions of laboratory experiments.

Where suitable facilities are available, it is also recommended that an advanced course be available to senior students. Many schools are able to offer the suggested course and an advanced course with only minor equipment additions. Slight modifications of the course can be made to suit existing facilities.

It is notable that the outline of the elementary course in foundry technology requires the student to prepare reports as well as witness demonstrations and perform experiments. Instead of making simple castings with relatively little instructional value, the student makes and pours molds which demonstrate principles of design, molding practice and behavior of metal during solidification. Other features of the course are the laboratory experiment on steel melting, the commercial foundry visitation and the lecture on special casting methods.

Outline—College Elementary Foundry Course

I. Lecture

A. Introduction to the Foundry Industry—The foundry and related industries, their background and importance. Classes of foundries. Differences between cast and wrought metals.

B. Molding Sands—History of molding sands, their importance. Basic ingredients of molding sands. Molding sand properties. Sand testing for moisture, permeability, compressive strength, fineness.

I. Laboratory

Sand testing demonstration for moisture content, permeability and strength.

II. Lecture

A. Molding Sands (cont.)—Relationship between molding sand ingredients and properties. Uniformity of sands. Surface finish, shrinkage, pin holes, blowholes, etc., as affected by sand quality. Sand handling. Sands for different metals. Synthetic sand. Facing sand. Mold washes, etc.

B. Core Sands—Basic ingredients of core sand mixtures. Core sand binders. Preparation of cores. Important properties of and tests for core sands. Functions of cores.

II. Laboratory

Sand test experiment to determine the influence of moisture variations on strength and permeability of two types of sand. Prepare report on results.

III. Lecture

Patterns—Use of patterns. Pattern types: loose, mounted, special patterns, sweep patterns, etc. Shrinkage allowance, draft, parting lines, locating points, attachment of gates and risers, tolerances required, pattern colors, etc. Molding methods and equipment: stripper machines, jolt-squeeze, jolt-squeeze-rollover, slingers, etc.

III. Laboratory

Bench and machine molding demonstrations. Technique, nomenclature, facing materials, etc.

IV. Lecture

Cast Steel—Introduction and definitions. Melting furnaces: acid and basic electric arc, converter, electric induction. General principles underlying melting practice. Molding and coremaking. Microstructural appearance and relation to analysis of steel. Effect of normal elements. Control of properties by control of analysis.

IV. Laboratory

Molding experiments to demonstrate various design and molding principles, such as fluidity test, surface finish, hot cracking, shrinkage, crystallization, progressive solidification vs. incorrect gating.

V. Lecture

Cast Steel (cont.)—Metallurgical phenomena associated with solidification of cast steel: contraction and crystallization. Design factors related to these phenomena: progressive solidification, section uniformity, use of chills and risers, use of fillets and rounded corners, bosses and lugs, ribs and brackets, pockets and holes. Other design factors: mass effect, fatigue, center-line shrinkage, hot tears, use of models. Illustrations of good and poor design.

V. Laboratory

Pour molds made in previous laboratory period in brass and examine results. Prepare report.

VI. Lecture

Cast Steel (cont.)—Properties and applications of carbon cast steels. High and low-temperature properties. Properties and applications of low-alloy cast steels and their heat treatment. Effect of the com-

mon alloying elements. High-alloy cast steels. Heat treatment and cleaning steel castings. Testing methods—destructive and non-destructive. Specifications and applications.

VI. Laboratory

Coremaking—Demonstration of mixing, molding and baking cores followed by experiments with various core mixtures and core boxes.

VII. Quiz

Material covered to date.

VII. Laboratory

Steel Heat—Demonstration of steel melting in an induction or arc furnace, illustrating principles of operation, pouring and molding practice required, effects of deoxidation, etc.

VIII. Lecture

Cast Iron—General information and definitions. The cupola furnace: construction, operation, equipment, cupola charges, principles related to its operations, coke-bed height, blast control, etc.

VIII. Laboratory

Floor molding demonstration and preparation of floor molds.

IX. Lecture

Cast Iron (cont.)—Composition of cast iron and its control. Comparison with cast steel. The interrelations of carbon content, silicon content and cooling rate. The effect of these factors on the microstructure of cast iron. The need for controlling silicon in the cupola. Effect of the common elements and the common alloying elements on the properties and microstructure of cast iron. The importance of graphite control. Types of cast iron. Heat treatment.

IX. Laboratory

Preparation of molds for cupola heat. Molds to demonstrate fluidity, shrinkage, etc., for cast iron.

X. Lecture

Cast Iron (cont.)—The important engineering properties of cast iron. The important casting properties of cast iron: low shrinkage, fluidity, low pouring temperature, etc. Comparison with cast steel. Classification of castings. Calculations of metal charges for the cupola.

X. Laboratory

Preparation of cupola for test heat.

XI. Lecture

Malleable Iron Castings—The air furnace. Composition of the metal. Molding and pouring practice. Design problems: relatively high shrinkage, section limitations, porosity, etc. Annealing practice. Microstructure. Properties. Uses and applications. Pearlitic malleables.

XI. Laboratory

Cupola heat.

XII. Quiz

Cast Iron and Malleable Iron.

XII. Laboratory

Clean-up of castings from cupola heat and analysis of results. Report on results.

XIII. Lecture

A. Aluminum-base Castings—Melting furnaces. Casting alloys. Foundry practice. Design considerations. Heat treatment. Uses and properties.

B. Magnesium-base Castings — Melting furnaces. Composition. Foundry practice and problems. Design considerations based on low specific gravity and shrinkage. Uses and applications.

XIII. Laboratory

Molding for aluminum heat. Molds to demonstrate various principles of design and to show behavior of aluminum.

XIV. Lecture

Copper-base Alloys—Melting Equipment. Melting principles. Copper castings, brass castings, bronze castings and high-strength brasses and bronzes. Comparative solidification characteristics of these metals which will influence design considerations.

XIV. Laboratory

Aluminum heat and clean-up of castings. Analysis of results.

XV. Lecture

A. Other Casting Alloys—Anti-friction alloys: copper-base, tin-base, lead-base, cadmium-base, nickel-base alloys. High temperature alloys.

B. General comparison of mechanical and physical properties of casting alloys.

XV. Laboratory

Special molding problems and "take-home" molding projects.

XVI. Lecture

A. Permanent-mold Castings—Cost, design, etc.

B. Die-casting—Die-casting machines, cost, design, casting alloys.

C. Precision Casting Methods—Process. Advantages and limitations.

XVI. Laboratory

Commercial foundry visitation.

An advanced foundry course for senior engineering college students is described in a paper by F. Holtby and H. F. Scobie entitled "A University Course in Foundry Control Methods," A.F.A. Transactions, vol. 49, p. 310 (1941). The course was in operation at the University of Minnesota until the beginning of the war. This type of course would be excellent for seniors, following an earlier basic course.

Apprentice Training Program Developed by So. California Chapter

The Apprentice Training Committee, A.F.A. Southern California chapter, held a dinner meeting June 5 at Rodger Young Auditorium, Los Angeles, Calif., and all local foundrymen interested in apprentice training were asked to attend. The object was to present the apprentice training program as developed by the chapter committee, under the chairmanship of J. E. Wilson, Climax Molybdenum Co., Los Angeles, to the representatives so that it might be placed in operation this fall. The program, as drawn up, consists of apprentice standards in the molder, coremaker and patternmaker trades for Southern California.

To fully explain the program and its function to those in attendance, the chapter had on hand Howard Campion, assistant superintendent of schools in charge of vocational education, and James R. Russell, U. S. Department of Labor, Apprentice Training Service.

FLAME GOUGING
Applications in the Steel Foundry

J. A. Shuffstall
Assistant Plant Manager
National Erie Corp.
Erie, Pa.

CHIPPING OPERATIONS performed on steel castings in the foundry cleaning section may be divided into four groups:

1. Green or so-called sand chipping prior to removing risers and before heat treating and annealing. Removal of slag produced in the pouring operation as a result of imperfect mold and core joints, brackets, etc., and in some cases small quantities of fused sand are included in this group.

2. Rough chipping employs pneumatic hammers and blunt chisels for the removal of hard or fused sand adhering to casting surfaces and pockets.

3. Removal of cracks, sand inclusions, shrinkage and porosity from the parent metal structure of shot and grit blasted castings, and the preparation of chipped areas for welding repair. This phase of the cleaning process involves the use of a large variety of hardened tool steel chisels, forged and ground to shapes to suit the contour of the area being excavated.

Proper preparation of chipped areas involves the use of both pneumatic and electric (high-cycle) grinders for removing torn metal, ridges and undercuts which might cause welding defects.

4. Chipping and grinding of welds after annealing or heat treatment. This consists of smoothing the casting surfaces on the welded area to the proper contour by means of chipping and grinding.

Repair Welding Preparation

In the foundry with which the author is associated, flame gouging has superseded the grinding operations listed in Group 3 as a method of excavating preparatory to repair welding. Also, flame gouging has been applied successfully to the removal of fins and brackets in locations which are difficult or inaccessible for chipping hammers.

Experience in this foundry has shown that a substantial saving has been effected in operating time and man hours. Although accurate cost records for the method have not as yet been developed, it is known that costs are substantially lower than with conventional methods; moreover, the conservation of man power is of greater importance inasmuch as it is possible to maintain production schedules with fewer chippers.

Castings containing defects to be flame gouged are marked in the defective regions by the cleaning room foreman or supervisor; also by inspectors working from radiographs. The castings are preheated in the defective areas with the preheating flame of the torch until the proper oxidizing temperature is reached, after which the gouging operation begins. The metal oxidizes rapidly and the slag is blown clear from the area.

Defects are readily distinguished during the operation. Experienced operators, familiar with the characteristics of the various defects, are able to follow the defect to complete removal. However, the operator continues to apply the preheating flame to the area in order to prevent too rapid cooling, which may result in cracking. Castings, if they are not to be machined, are ready for welding immediately after flame gouging. However, on castings subject to pressures, radiographic examination and machining, the flame-gouged surfaces should be ground or chipped to insure clean surfaces for weld material adherence, thus guaranteeing complete and satisfactory fusion of weld material to parent metal.

It is well known that experiments with the flame gouging process have been conducted in various steel foundries, and not always successfully. It is the author's belief that failures are the result of neglecting to remove the oxide film from the flame-gouged surface prior to welding. Also, that in many cases too much metal was removed, necessitating excessive welding.

Experience with flame gouging at this plant has shown that, if the operation has been properly performed, less metal is removed on a given surface than would be the case if chipping has been employed. This is particularly true where deep shrinkage cavities and deep cracks are to be removed.

For example, in order to reach a deep shrinkage with a chisel, the operator is compelled to chip at a fairly shallow angle. The excavated area is much larger at the upper surface than it would be if flame gouging had been employed. Furthermore, chipped areas often are found to be incomplete upon radiographic or magnetic particle examinations, due largely to the peening action of the chipping chisel, inherent to the chipping process, thus covering a portion of the defect.

Training Operators

It is necessary that flame-gouging operators (preferably welders) be properly trained and possess the requisite mental and physical qualifications. It should be emphasized that to place gouging equipment in the hands of even a good welder or burner and allowing him to work on actual castings probably would lead to disappointing results. It has been found that considerable practice on scrap is necessary before an operator can undertake some of the more simple preparations on usable castings, and then only under careful supervision. Further experience is necessary to develop manual skill and judgment. Once an operator has

been trained and acquired skill, however, the results will be gratifying to both man and foundry.

It is the practice in this foundry to identify by analysis the steels which may be safely flame gouged. Not all steels of over 0.40 per cent carbon content may be safely gouged, and some high-alloy steels not at all. However, low-alloy steels may be gouged in most cases.

This foundry has not experimented to any great extent on the gouging of the various alloy steels. It is believed, however, that an airhardening steel cannot be gouged without preheating. After preheating it should be gouged and welded while warm, and stress relieved immediately after welding.

Since adoption of the flame-gouging method, the cleaning room supervision does not trust a chipper to cut out a deep hot tear or a shrinkage cavity that is in a difficult place to reach, as experience has taught that in chipping out deep defects the bottom of the cavity has a tendency to peen. Instead, it is the practice to route such defects to the gouging unit.

It is not only the opinion of the cleaning room superintendent but also that of the production and foundry departments that flame gouging is one of the few advancements made in casting cleaning technique in many years. In addition to saving man hours in the cleaning room, it has improved the quality of the foundry's products.

The availability of flame gouging has been of great aid to the foundry engineer in that the design of many castings is such that risers and pads are required in places where they are difficult to remove by conventional methods. Since the gouging unit has been developed for use in removing risers and pads, riser design can be more properly maintained on the basis of controlled directional solidification.

Flame gouging equipment consists of gouging tips furnished by the manufacturers, and are made interchangeable with regulation cutting tips used in standard cutting torches. These blowpipes are of the oxygen-acetylene fuel type, and are controlled by standard gas line regulators. For flame gouging 50 to 90 psi oxygen and 12 to 15 psi acetylene pressures are used.

MANY NEW POLICIES FORMED BY CORRELATION COMMITTEE

THE AMERICAN FOUNDRYMEN'S Association Technical Correlation Committee, which establishes the technical policy of the Association, met June 20 in Chicago. National Director and Past President Fred J. Walls, International Nickel Co., Detroit and S. C. Massari, A.F.A. Technical Director, presided. The meeting was attended by outgoing and incoming chairmen of division and general interest committees.

The session was opened with reports of the past year's division and general interest committee activities and the Technical Correlation Committee took action as follows:

(1) Approved the organization of a Textbook Committee to prepare one or more textbooks on foundry practice which would be suitable for use in various types of educational institutions. This committee will be composed of representatives from each of the technical divisions, pertinent general interest committees and a representative of the Foundry Educational Foundation.

(2) Voted to adopt rules for division and committee personnel.

(3) Approved convention plans for the coming year, including the requirement that no technical paper should be scheduled for the convention without prior review and approval by the appropriate committee.

(4) Approved the use of a reviewer's form for criticizing papers submitted for presentation at the annual convention.

(5) Approved the December 15 deadline at which time papers for the annual meeting must be in the hands of the appropriate committee. Papers received after this date may be preprinted, whereas manuscripts prior to December 15 are assured of preprinting.

(6) Approved the revised A.F.A. publication policy.

(7) Agreed that papers, other than convention papers, which are published in AMERICAN FOUNDRYMAN should not be subject to approval of a Program and Papers Committee.

(8) Agreed that it is important for all A.F.A. committees and divisions to start immediately to secure papers for the 1948 convention and to hold a meeting of each division, executive committee and program and papers committee.

(9) Agreed that a joint meeting of the division executive committee and program and papers committee should be scheduled for each division early in September.

The Technical Correlation Committee also discussed the research program the Association is embarking upon through its various divisions and general interest committees. A number of them have already set up their own research project committees to point out some timely investigations needed by their particular industry. Funds have been appropriated by the Association to carry out the investigations at various colleges, universities and institutes.

Two of the divisions and one general interest committee have put their program into effect. The Aluminum and Magnesium Division is sponsoring an investigation at Battelle Memorial Institute, Columbus, Ohio; the Sand Division at Cornell University, Ithaca, N. Y., and the Heat Transfer Committee at Columbia University, New York. Other divisions and general interest committees of the Association are expected to have their programs lined up and ready to put into operation within a short time.

Standard Horse Nail Celebrates 75th Year

THE STANDARD Horse Nail Corp., New Brighton, Pa., is currently celebrating its 75th year of service to the foundry and other industries. Established in 1872, the company is one of few to boast of such a record.

ENCOURAGING YOUTH TOWARD FOUNDRY INDUSTRY CAREERS

INCREASED EMPHASIS upon arousing the interest of young men in a future as foundry workers has made youth encouragement one of the major activities of the A.F.A. Educational Division. To meet present needs of the castings industry, the Youth Encouragement Committee will work with primary and high schools in developing a program of early contact and understanding of the foundry industry. Considerable aid in the promotion of this program is expected from chapter educational committees.

A number of ideas have been developed by the Youth Encouragement Committee through contacts with guidance directors, school officials and foundrymen. Following are some of the phases of the program now under consideration:

1. Illustrated posters on foundry jobs which could be posted on high school bulletin boards, in vocational counselors' offices, etc.

Practical Information

2. Illustrated monographs on the various foundry jobs to be used in giving information to high school students. Printed in 8½x11-in. size and written by practical foundrymen, these monographs would be useful in career classes, manual arts classes, social study classes, English classes, etc. They also could be used in home rooms for home room discussions, and for library displays and references. This group of prints would be built on a series basis and mailed monthly.

3. Visual aids such as movies, brochures, illustrations of casting uses, foundry work and similar items which could be shown in career and occupational classes, home room assemblies, etc.

4. Circuit speakers, provided by A.F.A. chapters, who could address high school assemblies in the chapter district and who would spend the balance of the day in the school talking privately or to groups of interested students. These speakers should understand high school procedure and curriculum, be able to speak to the students at the school level and outline clearly the working conditions and opportunities in the foundry industry.

5. Foundry tours for members of the high school and grade school faculties to show them that the foundry offers a career, and also impress upon them the nature of the operations and the type of training and school subjects helpful to students interested in such a career.

6. Foundry tours for school students of the ninth grade and the twelfth grade levels. In the case of the ninth grade student, the purpose is to familiarize the boy with foundry work so that he will be impressed with the foundry as a place to work and can plan his high school studies accordingly. In the case of the twelfth grade student, the object is to give him further information regarding studies he should make in college, or to make the necessary industry contact if the student is coming into the foundry on an apprentice level.

While much can be done to stimulate youth interest in schools, it should be borne in mind that the greatest resistance to foundry work found by guidance directors is due to adverse advice from poorly informed parents and foundry employees. To overcome this it is necessary to encourage foundry workers to be proud of their employment. The development of father and son employee combinations would go far toward stabilizing the future personnel of our industry. Foundry visitations planned for teachers and students might well be arranged to include parents so that they can see firsthand what the castings industry is like.

The Youth Encouragement Committee is comprised of B. D. Claffey, General Malleable Corp., Waukesha, Wisc., chairman; Walter Gerlinger, Walter Gerlinger, Inc., Milwaukee; J. A. Gitzen, Delta Oil Products Co., Milwaukee; H. H. Judson, Standard Foundry Co., Worcester, Mass.; C. R. McGrail, Texaloy Foundry Co., San Antonio; F. J. Walls, International Nickel Co., Detroit; R. C. Wood, Minneapolis Electric Steel Castings Co., Minneapolis; Wayne Stettbacher, Employers' Association of Detroit, Detroit, and L. N. Shannon, Stockham Pipe Fittings Co., Birmingham. These men are continuing in the development of a youth encouragement program and are looking to chapter educational committees for assistance in its execution.

Can You Help?

A.F.A. is anxious to obtain some copies of A.F.A. TRANSACTIONS, Volume 52 (1944) from members who may have no use for copies in their files. The supply of this volume is entirely exhausted and a number of important requests have been received for this edition.

For intact copies in good condition A.F.A. will be glad to make arrangements for purchase. If you have a copy of Volume 52 which you do not need, please forward promptly to: The Secretary, American Foundrymen's Ass'n, 222 West Adams Street, Chicago 6, Ill.

Invite U.S. Foundrymen To Prague in 1948

AN INTERNATIONAL Foundry Congress will be held in Prague, Czechoslovakia, August, 1948. Exact dates for this affair have not been set.

Official invitation for American foundrymen to participate in this event was extended by Dr. Josef Koritta, head, Czechoslovak Casting Research Institute, and Ing. Ondrej Starosta, assistant to managing director, Zbrojovka Brno Gaua Foundry, Tynec, representatives of the Czechoslovak Foundrymen's Association who attended the 51st Annual A.F.A. Convention.

English Foundry Show Set for August

THE FIRST Foundry Trade Exhibition in England for ten years will be held August 28-September 17 in London. The Foundry Exhibition will form an integral part of the Engineering and Marine Exhibition which is normally held every other year.

Foundry Sand Reclamation

(Continued from Page 39)

high, compared with rake or spiral classifiers, being on the order of 200 to 400 gal per ton. The capacity of the table used in pilot mill tests was at least 300 to 400 lb per hour. Such a piece of equipment would cost less than $1000. In each case the slime product would be pumped to a settling tank, from which the overflow could go to sewer disposal. The sand products would likewise go to a settling tank, from which overflow water could be returned to the system and the sand product dewatered by a drag and drainage bin, or filter. This product, with or without drying, would be suitable for most molding work, and for certain types of cores.

3. If calcination appeared desirable, a furnace would have to be installed as well. This should be sufficiently large to provide a minimum of 5 min treatment of sand at 1400 to 1500 F, starting with feed at 6 or 7 per cent moisture. A small oil-fired rotary would be suitable, and could be constructed locally at low cost.

If desired, the calcined product could be passed through a high-intensity magnetic separator to eliminate all slag and scale particles, but this step probably would be unnecessary, particularly when the Wilfley table was incorporated in the flow sheet. One possible flow sheet for a reclamation plant with an approximate capacity of one ton per hour is shown in Fig. 4.

Accurate cost estimates are impossible without definite selection of specific equipment. However, it should be possible to install the plant outlined in Fig. 4 for less than $10,000, using standard equipment, and possibly for as little as $5000 if second-hand or locally constructed equipment were used.

Using Available Equipment

For a foundry already having a muller of suitable size, the ball mill or tumbler could be dispensed with. Where most of the sand would be used in a washed but uncalcined condition, a relatively small furnace would be adequate. Cost of reclamation plant in this instance should not exceed $5000 or $6000.

Operating costs for a plant handling one ton per hour should be less than $2.00 per ton of washed product including labor, power, water, and maintenance. Total cost of producing calcined sand should not exceed $2.50 to $3.00 per ton. Assuming a plant cost of $10,000, with a 5 year write-off, interest plus amortization would amount to about $2.50 per ton if only 1000 tons were treated per year, or $1.00 per ton if 2500 tons were treated. Estimated total costs, therefore, on the basis of 1000 tons per year and a $10,000 plant investment, would be in the order of $5.00 to $6.00 per ton, or, on the basis of a $5000 plant and 2500 tons per year, would be from $3.00 to $3.50.

The foregoing figures are based upon a foundry installing its own reclamation plant to treat its own sand. Arrangements could possibly be made to treat waste sand from other foundries, in which event handling charges probably would amount to an additional $3.00 per ton, making the total cost about $7.00 per ton for sand produced from outside sources, using a plant worth $10,000. However, it is probable that the original investment would be considerably less, which would be reflected in a reduction in over-all costs.

Present charges for waste sand disposal range from $0.50 to $1.00 per ton, which would be reduced to one-fifth by the installation of a sand reclamation system making 80 per cent recovery. The saving of $0.40 to $0.80 thus effected would be a credit against the operating cost of the reclamation plant.

Bibliography

1. D. L. Longueville and O. Jay Myers, "Core-Sand Reclamation at Elevated Temperatures," Transactions, American Foundrymen's Association, vol. 51, pp. 198-206 (1943).

2. W. L. Hartley, "Thermal Process of Core-Sand Reclamation," Transactions, American Foundrymen's Association, vol. 51, pp. 207-212 (1943).

3. Curtis, "Thermal Reclamation of Core Sand," *Aluminum and Magnesium,* September, 1945.

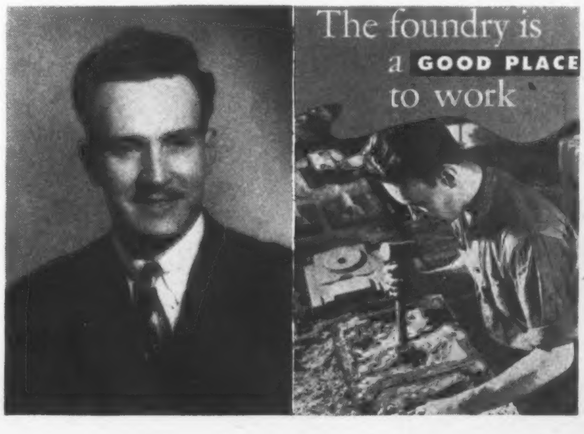
4. F. E. Fisher and A. C. Den Breejen, "The Reclamation of Foundry Sands," published by Hydro-Blast Corp., Chicago.

Cover Champ

Frank Unger comes from Los Angeles but does not have aspirations to become a Clark Gable or Tyrone Power—although quite handsome (see cut)—however, he is a "class A core maker" at Westlectric Castings, Inc., Los Angeles. Therefore, while browsing through a bulletin issued by the above concern we spotted a young man ramming up a core box; it seemed ideal to use as a cover for American Foundryman. Writing to Bill Bailey, Jr., vice-president and general manager of the firm and past chairman, A.F.A. Southern California chapter, we secured a copy of the picture and permission to use it (March, 1946). The cover made such an impression that the A.F.A. Educational Division put it to further use by placing it on the cover of The Foundry is a Good Place to Work (see cut below).

After seeing Frank's profile we were rather inquisitive and asked for a photograph (below, left) to satisfy our curiosity as to his facial features. Enclosing same in a recent letter Bill Bailey adds "Frank joined Westlectric in 1941."

Frank Unger (left) and as he appeared on the front cover of two A.F.A. publications.



MACHINISTS ACQUAINTED WITH MODERN FOUNDRY OPERATIONS

FIRST-HAND ACQUAINTANCE with foundry technology was acquired by 30 apprentice machinists from Ingersoll Milling Machine Co., who were guests May 22 of the Beloit (Wis.) Foundry Co. on a special plant visitation and dinner meeting program arranged by the two cooperative manufacturing firms.

The event, an example of foundry industry promotion of the type recommended by the A.F.A. Educational Division and sponsored in some areas by chapter educational committees, gave the apprentices a better understanding of the nature of castings and the methods and problems concerned with production.

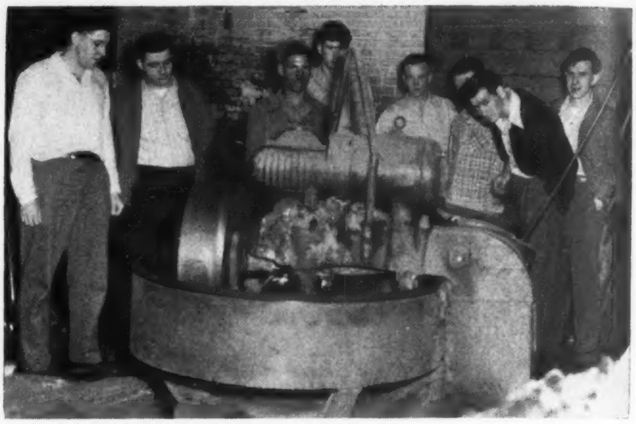
In the afternoon the boys toured the plant, accompanied by representatives of the foundry who explained the techniques and practices involved in the manufacture of sound castings. To provide more opportunity for discussion and permit all the apprentices a "close-up" view, the group was divided into three smaller parties, which went through the foundry separately.

All the visitors demonstrated keen interest in the operations witnessed and the equipment inspected during the trip. Questions and general discussion ran high at several points, as the guides outlined the fundamentals of melting, molding, pouring and metallurgical and sand control.

Halverson Speaks at Dinner

A review of all they had seen and learned in the afternoon was provided the boys that evening following a social hour and the dinner. H. F. Halverson, president of Beloit Foundry Co., spoke briefly on the various phases of foundry activity covered in the visitation. His remarks were followed by the showing of a color motion picture of foundry production processes at Electric Steel Castings Co., Indianapolis.

Vern Lentz, head of the apprentice program at the Ingersoll firm, expressed the appreciation of his organization for the arrangements, and introduced Mr.



Visitors watching a sand muller in operation.

Halverson to the boys. Jack O'Leary, the Ingersoll company's general manager, and other firm officials were introduced at the dinner.

As a result of their visit, the apprentices, all ex-servicemen, gained a working knowledge of the properties and characteristics of castings and of foundry production methods which will be of value in their work. Local papers and other firms in the area also evinced considerable interest in the program.

Beloit Foundry Co. is one of a number of local organizations cooperating with Rockford College in the training of engineering students sponsored by interested industries. The future engineers acquire a varied and practical background of approximately two-years' industrial work with various companies while completing their formal four-year education.

Five students recently spent four months in the Beloit foundry, Mr. Halverson reports. During their stay they participated in all phases of foundry work, and did an excellent job, he said, adding that "We were well pleased with the results in the foundry, and will be glad to see other students come into our plant under the plan."

Apprentice machinists of the Ingersoll Milling Machine Co. were recent guests of the Beloit Foundry Co., Beloit, Wis. They were conducted through the plant during the day and in the evening were invited to attend a dinner at which H. F. Halverson, president of the Beloit firm, spoke briefly and a movie shown.

FOUNDRY PERSONALITIES

W. W. Edens, formerly technical director for Ampco Metal, Inc., Milwaukee, has joined Badger Brass & Aluminum Foundry Co. of the same city. He has been associated with the Ampco firm since 1937. Mr. Edens is Chairman, A.F.A. Brass and Bronze Division, and a director of Wisconsin chapter.

C. H. Nock has been elected president; **G. J. Nock,** vice president-secretary, and **R. L. Nock,** treasurer of Nock Fire Brick Co., Cleveland. **C. J. Nock** has resigned as vice president and has acquired the firm formerly known as Nock & Sons Co., which he is now operating under the name of Nock & Son Co.

W. H. Moriarity, vice president of National Malleable & Steel Castings Co., Cleveland, was elected president of the Malleable Founders Society at the recent convention in Hot Springs, Va. **Collins Carter,** president of Albion (Mich.) Malleable Iron Co., was elected vice president and a director of the society.

Also named directors were **C. A. Gutenkunst, Jr.,** president, Milwaukee Malleable & Gray Iron Works, of that city; **J. H. Smith,** general manager, Central Foundry Div., General Motors Corp., Saginaw, Mich., and **F. D. Brisse,** president of Laconia (N. H.) Malleable Iron Co.

C. J. Hardy, Jr., executive vice president, American Car & Foundry Co., was elected president at a recent meeting of the board. In his new capacity, Mr. Hardy succeeds **F. A. Stevenson,** who has resigned after more than 40 years with the firm.

Rudolph Furrer has been elected vice president in charge of engineering, American Car & Foundry Co., New York, succeeding E. D. Campbell, who retired recently due to ill health. A research and development engineer, Mr. Furrer served during the war with the War Metallurgy Committee and as a special consultant in ordnance research and development.

J. G. Paule has been appointed vice president and general manager of Wilson Foundry & Machine Co., Pontiac, Mich. Associated with the firm since 1937, Mr. Paule has served as secretary-treasurer. He is succeeded in that capacity by **Myron Hill,** formerly comptroller. **B. E. Drury,** who has been sales manager, was promoted to general sales manager.

J. G. Paule

J. H. Binger, assistant secretary of Minneapolis-Honeywell Regulator Co., Minneapolis, since 1945, was named assistant vice president by the board recently.

W. C. Johnson and **W. A. Roberts** have been appointed executive vice presidents of, respectively, the general machinery and tractor divisions of Allis-Chalmers Mfg. Co., Milwaukee. The firm has also announced the appointments of **M. L. Noel** as tractor division vice president and general sales manager, and **J. L. Singleton,** vice president and director of sales, general machinery division.

H. W. Kayser

H. W. Kayser, Falk Corp., Milwaukee, was recently appointed supervisor of development engineering. Graduate of Marquette University college of engineering, 1931, he has been associated with Falk Corp. since and has served as designer, application engineer and development engineer during his affiliation.

H. J. Fraser, vice president of International Nickel Co., Inc., New York, has been placed in charge of all plant operations of the company in the United States. **J. A. Marsh,** assistant general manager of the firm's Huntington, W. Va., works, has been named assistant to Mr. Fraser.

C. M. Brooks recently resigned as superintendent of Busch Sulzer Bros. Diesel Engine Co., St. Louis, to accept a similar position at Scovel Mfg. Co., Benton Harbor, Mich. An active member of A.F.A., he is with St. Louis District chapter.

L. R. Boulware, a vice president of General Electric Co., New York, has been assigned responsibility for employee relations. He succeeds, in his new duties, **E. D. Spicer,** also a vice president of the firm, who assumes responsibility for manufacturing policy and continues as a member of the president's staff. The direction of operations of nine manufacturing affiliates, formerly handled by Mr. Boulware, has been placed temporarily in the charge of **R. J. Cordiner,** vice president and assistant to the president.

G. J. Easter has been appointed director of research for Electro Refractories & Alloys Corp., Buffalo, N. Y. He was formerly manager of research and development, Carborundum Co., Niagara Falls.

G. E. Bean, managing director of the Wilmington, Del., works of Eastern Malleable Iron Co., was presented with the first Charles H. McCrea medal, founded by National Malleable & Steel Castings Co. in memory of its late president.

R. J. Roshirt, since 1935 in charge of foundry production for Bohn Aluminum & Brass Corp., Detroit, was appointed general manufacturing manager recently. For 32 years associated with the metallurgy and manufacture of non-ferrous metals, he has been with Bohn since 1919.

H. C. Wallace, associated with Air Reduction Sales Co. at Louisville, Ky., since 1929 and recently assistant district manager, has been appointed manager.

J. A. Baldinger, for the past two years assistant sales manager of the truck division. Automatic Transportation Co., Chicago, has been named assistant to the general manager.

R. C. Disney, formerly manager of eastern district sales for Baldwin Locomotive Works, Philadelphia, has been promoted to assistant general sales manager.

Gerard Dochez, metallurgist with Bruneau Light Alloys Foundry, Orleans, France, was a recent visitor to the A.F.A. National Office. He is spending several months in North America inspecting aluminum foundries and metallurgical laboratories.

R. T. Spear was recently appointed a regional sales manager for All-State Welding Alloys Co., Inc., White Plains, N. Y.

J. W. Price, Jr., Rose Polytechnic Institute, Terre Haute, Ind., and **Howard Sanders,** Cornell University, Ithaca, N. Y., have been awarded first and second prize, respectively, in the American Welding Society's 1947 A. F. Davis undergraduate welding competition.

F. L. Ebersole, formerly mechanical engineer with American Rolling Mill Co., Middletown, Ohio, recently joined Loewy

(Continued on Page 84)

★ NEW A. F. A. MEMBERS ★

[illegible] Chapters [illegible] and 37, Central Michigan and [illegible] Columbia [illegible], set the pace this month [illegible] and [illegible] on their roster lists, [illegible] company members. Chicago continues to maintain its edge over the "Old Timers" by posting a 10 man addition. All told thirty-two A.F.A. chapters are reporting an increase with a total of 165 new members gained.

Conversion-Personal to Company
***Lakeside Foundry, Warsaw, Ind. (Mrs. Frances J. Kaufman)**

BIRMINGHAM DISTRICT CHAPTER

F. W. Jarnagin, Patt. Frm., Harrison & Corry Co., Knoxville, Tenn.

BRITISH COLUMBIA CHAPTER

***British Columbia Tube Works Ltd., Vancouver. (A. Hethey, Pres.)**
***Mainland Foundry Co. Ltd., Vancouver. (James S. Graham, Asst. Gen. Mgr.)**
***Reliance Foundry Co. Ltd., Vancouver. (Fred E. Done, Supt.)**
***Victoria Machinery Depot Co. Ltd., Victoria. (F. Diment, Fdry. Supt.)**
Eugene J. Allaire, Mgr., Georgia Foundry Ltd., Vancouver.
Howard M. Brownrigg, Asso. Res. Met., British Columbia Research Council, Vancouver.
F. L. Coltart, Prop., Maple Leaf Pattern Works, Vancouver.
William D. Cooper, Sls. & Service Rep., Canadian Industries Ltd., Vancouver.
J. Crossley, Moulder, Vivian Engine Works Ltd., Vancouver.
G. Davison, Mgr., Northwestern Brass & Bronze Foundry, Vancouver.
Herbert Fleck, Chief Melter, A-1 Steel & Iron Foundry Ltd., Vancouver.
Dean H. Goard, Prin., Vancouver Vocational School, Vancouver.
F. C. Hooper, Frm. C/Maker, A-1 Steel & Iron Foundry Ltd., Vancouver.
S. V. McDonald, Mgr., A-1 Steel & Iron Foundry Ltd., Vancouver.
S. E. Maddigan, Dir., B. C. Research Council, Vancouver.
John Minot, Frm. Moulder, Vivian Engine Works, Vancouver.
John A. Moka, Moulder, Vivian Engine Works, Vancouver.
J. B. Ness, Frm. Pttnmaker., Canadian Sumner Iron Works, Vancouver.
C. J. Olstead, Asst. Frm., Canadian Sumner Iron Works, Vancouver.
Norman Shewring, Slsm., Industrial Supplies Ltd., Vancouver.
Arthur Silvestrone, Supt., A-1 Steel & Iron Foundry Ltd., Vancouver.
Joseph Spence, Pres., Overseas Commodities Ltd., Vancouver.
Samuel C. Stewart, Fdry. Frm., Canadian Sumner Iron Works Ltd., Vancouver.
Norman Terry, Sec.-Treas., Canadian Sumner Iron Works Ltd., Vancouver.
C. H. Watters, Patt. Frm., A-1 Steel & Iron Foundry Ltd., Vancouver.
L. P. Young, Met., A-1 Steel & Iron Foundry Ltd., Vancouver.

CENTRAL ILLINOIS CHAPTER

Ralph O. Cox, Gen. Frm., The Oliver Corp., Shelbyville.

CENTRAL INDIANA CHAPTER

Fred Carl, Met., Danville Plt., Central Fdry. Div., GMC, Danville, Ill.
Joseph P. Enright, Abras. Engr., Norton Co., Worchester, Mass.
J. E. Meers, Chemist, Danville Plt., Central Fdry. Div., GMC, Danville, Ill.
J. H. Woodling, Melter, National Malleable & Steel Castings Co., Indianapolis.

CENTRAL MICHIGAN CHAPTER

***Brooks Furnace Co., Albion. (Ralph Brooks, Pres.)**
***Fuller Mfg. Co., Kalamazoo. (Frank C. McManus, Factory Mgr.)**
***Homer Furnace & Foundry Corp., Coldwater. (H. J. Sissem)**
***U. S. Foundry Corp., Kalamazoo. (Erwin Doerschler, Pres.)**
Emil Brooks, V. P., Brooks Furnace Co., Albion.
Forrest Cook, Supt., U. S. Foundry Corp., Kalamazoo.
James M. Crowley, Pioneer Foundry Co., Jackson.
Leo J. Crowley, Pioneer Foundry Co., Jackson.
William J. Crowley, Pioneer Foundry Co., Jackson.
Oral J. Drumm, Fdry. Mgr., Battle Creek Breadwrapping Machine Co., Battle Creek.
Nelson E. Dumas, V. P. & G. M., Trojan Castings Co., Jackson.
Asa A. Durren, Gen. Mgr., Three Rivers Casting Co., Three Rivers.
Roy A. Durren, Asst. Gen. Mgr., Three Rivers Casting Co., Three Rivers.
R. W. Fierke, Homer Furnace & Foundry Corp., Coldwater.
J. H. Gardner, Marshall Furnace Co., Marshall.
Ralph C. Hatfield, Supt., Three Rivers Casting Co., Three Rivers.
Kenneth Jackson, Linton & Jackson, Coldwater.
Glenn C. Kemler, Chief Insp., Albion Malleable Iron Co., Albion.
R. E. Lewis, Supt., Reed Foundry & Mfg. Co., Kalamazoo.
Frank H. Linton, Linton & Jackson, Coldwater.
Harry O. McCool, Fdry. Supt., American-Marsh Pumps, Inc., Battle Creek.
Eugene J. Martin, Pioneer Foundry Co., Jackson.
John Millar, Duplex Printing Press Co., Battle Creek.
Roy A. Miller, Iron Fdry. Frm., U. S. Foundry Corp., Kalamazoo.
Richard C. Nass, Albion Malleable Iron Co., Albion.
Carl Norton, Brooks Furnace Co., Albion.
P. F. Sullivan, Melting Frm., Albion Malleable Iron Co., Albion.
Harvey Washburn, C/R Supt., Battle Creek Bread Wrapper Co., Battle Creek.
H. J. Westenhiser, Secy. & Treas., U. S. Foundry Corp., Kalamazoo.
John E. Wolf, Plt. Mgr., Midwest Foundry Co. (Div. L. A. Darling Co), Coldwater.
M. W. Wolfe, Pres. & Treas., Trojan Castings Co., Jackson.
John A. Zeindler, Asst. Chief Insp., Albion Malleable Iron Co., Albion.

CENTRAL NEW YORK CHAPTER

Arthur C. Hintz, Sls. Repr., Hines Flask Co., Cleveland.

CENTRAL OHIO CHAPTER

Cyril W. Braun, Dist. Mgr., Laclede Christy Clay Products Co., St. Louis, Mo.
C. O. Briner, Fdry. Supt., Alten's Foundry & Machine Works, Lancaster.
Sylvan Grotte, V. P. & Gen. Mgr., H. B. Salter Mfg. Co., Marysville.
Waldemar W. Weber, Cost Acct., Alten's Foundry & Machine Works, Lancaster.

CHESAPEAKE CHAPTER

***The Richmond Foundry & Mfg. Co., Inc., Richmond, Va. (J. Scott Parrish, Jr., Pres.)**
Andrew R. Campbell, Fdry. Frm., The Richmond Foundry & Mfg. Co., Inc., Richmond, Va.
Lewis T. Crump, Fdry. Supv., The Richmond Foundry & Mfg. Co., Inc., Richmond, Va.
Albert N. Meyer, Pres., The Harr-Vinn Foundry Co., Baltimore.
Archie Woolridge, Fdry. Supv., Lynchburg Foundry Co., Lynchburg, Va.

CHICAGO CHAPTER

***Standard Pattern Works, Chicago (Harry Christenson)**
Walter A. Balton, Gen. Frm., Link-Belt Co., Chicago.
Fred C. Hayward, C/R Frm., Chicago Foundry Co., Chicago.
Ellis A. Heilbronn, V. P., U. S. Reduction Co., East Chicago, Ind.
Robert S. Kahn, Slsm., R. Lavin & Sons, Inc., Chicago.
Robert P. Lawrance, Dev. Engr., The Titanium Alloy Mfg. Co., Niagara Falls, N. Y.
Glenn Leeman, Pres., Crane Technical High School, Chicago.
A. J. Schilling, Perm. Mold Engr., Howard Foundry Co., Chicago.
Earl S. Schwartz, Works Mgr., H. Kramer & Co., Chicago.
Charles W. Streeter, Methods & Eff. Engr., Paramount Textile Machine Co., Kankakee, Ill.

CINCINNATI DISTRICT CHAPTER

Adrian G. Brock, Fdry. Frm., The Treaty Co., Greenville, Ohio.
Christopher Feller, Owner, Feller Pattern & Foundry Co., Cincinnati.
E. L. Geswein, Fore., Dayton Castings Co., Dayton, Ohio.
Forest L. W. Link, Chief Prod. Engr., The Schaible Co., Cincinnati.
M. M. Tillinger, Fore., Dayton Castings Co., Dayton, Ohio.

DETROIT CHAPTER

Jack Blyth, Met., Walker Metal Products Ltd., Walkerville, Ontario.
Louis P. Chalfant, Fore., Pontiac Motor Car Div., GMC, Pontiac, Mich.
Gerald A. Conger, University of Michigan, Ann Arbor.
Vincent Dixie, Clean. Room Fore., Budd Wheel Co., Detroit.
George F. Hunter, Molding Fore., Pontiac Motor Car Div., GMC, Pontiac, Mich.
Harry Oldham, Ford Motor Co., Dearborn, Mich.
C. Eugene Silver, Engr., Lester B. Knight & Associates, Inc., Chicago.
Claude L. Stevens, Met. Process Control, Rouge Plt., Ford Motor Co., Dearborn, Mich.
Anthony Yaeger, Asst. Supt. Insp., Pontiac Motor Car Div., GMC, Pontiac, Mich.

E. CANADA & NEWFOUNDLAND CHAPTER

Herbert Shapiro, Gen. Mgr., Matthew Moody & Sons Co., Terrebonne, P. Q.

METROPOLITAN CHAPTER

***T. Shriver & Co., Inc., Harrison, N. J. (William L. Hutton, Fdry. Supt.)**
Carl A. Carlson, Sls. Engr., Norton Co., Worcester, Mass.
John B. Guthrie, Jr., Sls., Federated Metals Div., A. S. & R. Co., N. Y.

MEXICO CITY CHAPTER

Angel Corona, Fundicion Corona, Puebla.

* Company Membership

MICHIANA CHAPTER

Karl F. Richter, Expediter, The La Bour Co., Inc., Elkhart, Ind.
Roy O. Sheets, Fdry. Supt., Process Metals Co., White Piegon, Mich.

NORTHEASTERN OHIO CHAPTER

Claude A. Armstrong, Res. Mgr., The Cincinnati Railway Supply Co., Cleveland.
L. M. Brown, Mgr., Chicago Pneumatic Tool Co., Cleveland.
R. J. Gollmar, Prod. Mgr., Elyria Foundry, Elyria, Ohio.
R. C. Little, Plt. Met., National Radiator Co., New Castle, Pa.
W. H. Owen, Sls. Engr., C. O. Bartlett & Snow Co., Cleveland.
M T. Sell, Stand. & Methods Supv., Sterling Foundry Co., Wellington, Ohio.

NORTHERN CALIFORNIA CHAPTER

Robert L. Novack, Mgr., Associated Smelting Corp., Oakland.
John W. Steele, Slsm., Pacific Graphite Co., Inc., Oakland.
William C. Wolff, General Metals Corp., Oakland.

ONTARIO CHAPTER

L. E. Demill, Owner, Demill Metal Patterns, Galt.
John A. Wotherspoon, Partner, Bibby Foundry, Galt.

OREGON CHAPTER

Cecil J. Davis, Davis Pattern Works, Portland.

PHILADELPHIA CHAPTER

E. A. Anderson, Chief Metal Section, The New Jersey Zinc Co. of Pa., Palmerton, Pa.
Michael B. Creed, Mullite Refractories Co., Shelton, Conn.
Edward Saks, Inst., Murrell Dobbins Vocational School, Philadelphia.

QUAD CITY CHAPTER

*John H. Best & Sons, Galva, Ill. (Leon H. Best, V. P.)
Robert J. Bennett, Fdry. Frm., Red Jacket Mfg. Co., Davenport, Iowa.
Leon Burnett, Fdry. Supt., John H. Best & Sons, Galva, Ill.
Robert C. Franck, Chief Chemist, The S & W Corp., Bettendorf, Iowa.
Robert J. Groves, Fdry. Frm., Red Jacket Mfg. Co., Davenport, Iowa.

ROCHESTER CHAPTER

H. A. Kohlmeier, Secy.-Treas., Ste-Kol Plaster Castings Inc., Rochester.

ROCKY MOUNTAIN EMPIRE CHAPTER

R. A. Bolen, Bolen Machine Works, Grand Junction, Colo.

SAGINAW VALLEY CHAPTER

W. James Bill, Plt. Engr., Dow Chemical Co., Bay City, Mich.
R. E. Fredrickson, Supv. Met. Dept., Central Fdry. Div., GMC, Saginaw, Mich.
Harlan T. Pierpont, Abras. Engr., Norton Co., Worcester, Mass.
F. W. Richter, Fdry. Frm., Chevrolet Grey Iron Fdry. Div., GMC, Saginaw.

SOUTHERN CALIFORNIA CHAPTER

Robert C. Dean, Industrial Systems Co., Los Angeles.

TEXAS CHAPTER

J. H. Cupp, Supt., Refinery Castings Co., Dallas, Tex.

TRI-STATE CHAPTER

W. R. Blunk, Owner, Triple J. Pattern Works, Tulsa, Okla.
Norman E. Libby, Fdry. Frm., Service Foundry Inc., Wichita, Kan.
C. O. Loveless, Partner, F. & L. Pattern Works, Tulsa, Okla.
O. K. McGill, Frm., American Pattern Co., Tulsa, Okla.
Ivan Morrow, Owner, Ivan Morrow Pattern Shop & Foundry, Coffeyville, Kan.
Hans A. Norberg, Mgr., Nelson Electric Mfg. Co., Tulsa, Okla.
L. R. Streiff, Sales Rep., Midwest Foundry Supply Co., Edwardsville, Ill.
Robert H. Timberlake, Slsm., Metal Goods Corp., Tulsa, Okla.

TWIN CITY CHAPTER

Bob Bedore, Met., Winona Plt., Donovan Inc., Winona, Minn.

WASHINGTON CHAPTER

Charles Elmer, Eagle Pattern & Mfg. Co., Seattle.
C. C. Warn, Slsm. & Engr., Brumley-Donaldson Co., Seattle.

WESTERN MICHIGAN CHAPTER

Robert DeVore, Supv. Melt. Dept., Lakey Foundry & Machine Co., Muskegon.
Stephen Kota, Quality Analyst, Lakey Foundry & Machine Co., Muskegon.

WESTERN NEW YORK CHAPTER

John R. Lewis, Dev. Engr., Titanium Alloy Mfg. Co., Niagara Falls.
Arnold J. Martin, Samuel Greenfield Co. Inc., Buffalo.

WISCONSIN CHAPTER

*Wisconsin Cylinder Foundry, Inc., Racine, Wis. (Arnold Niess, Asst. Treas.)
Walter E. Brandt, Met., Pelton Steel Casting Co., Milwaukee.
O. P. Ketter, Pur. Dept., The Oilgear Co., Milwaukee.
L. M. McMahon, Sales Mgr., Walter Gerlinger, Inc., Milwaukee.
Hans A. Nelson, Secy.-Treas., National Aluminum Co. Inc., Racine, Wis.
G. A. Stolze, Met., Allis-Chalmers Mfg. Co., Milwaukee.

OUTSIDE OF CHAPTER

National Health Institute Library, Rockville Pike, Bethesda, Md.
C. F. Reininger, Pres. & Gen. Mgr., Powhatan Brass & Iron Works, Ranson, W. Va.
Armin Sonderegger, Fdry. Engr., Zelienople, Pa.

ARGENTINA

Alfredo B. Gatti, Dir. Mgr., Compania Argentina de Talleres Industriales, Transportes y Anexos S/A, Buenos Aires.

BELGIUM

Sylvian Pierard, Chief Met., Usines & Acieries Allard S A, Marchienne.
Robert Richard, Dir. Gen., Usines & Acieries Allard (Steel Cstgs), Marchienne.

CHINA

Sung Sing Cotton Mill No. 4, Pocki, Shensi.

ENGLAND

Alfred Allcock, Allcock & Co (Metals) Ltd., Birmingham.

FRANCE

Fonderies Montupet, Paris.

POLAND

Edward Bucko, Engr., Metallurgical Research Institute, Gliwice.

* Company Membership

FUTURE CONVENTIONS AND EXHIBITS

American Society of Civil Engineers, Duluth, Minn.—July 14-18.

National Association of Power Engineers, Boston, Mass.—Aug. 25-29.

American Society for Mechanical Engineers, Fall Meeting, Salt Lake City, Utah—Sept. 1-4.

Instrument Society of America, Second National Conference, Stevens Hotel, Chicago—Sept. 8-12.

American Chemical Society, 112th Meeting, New York—Sept. 15-19.

National Machine Tool Builders' Association, Machine Tool Show, Cleveland —Sept. 17-26.

American Institute of Chemical Engineers, Regional Conference, Buffalo, N.Y.—Sept. 29-Oct. 1.

American Gas Association, San Francisco —Sept. 29-Oct. 3.

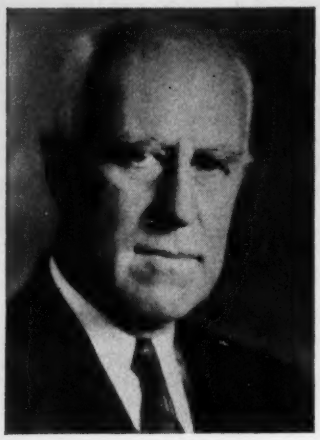
American Welding Society, National Metal Congress & Exposition, Sherman Hotel, Chicago—Oct. 20-24.

American Institute of Mechanical Engineers, Fall Meeting, Iron & Steel Div., & Institute of Metals Div., Stevens Hotel, Chicago—Oct. 20-22.

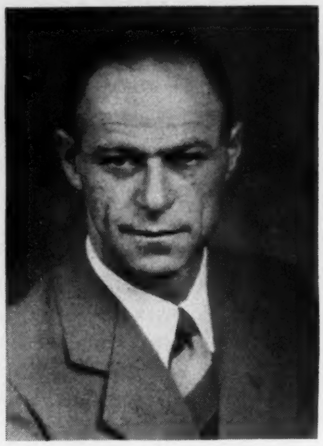
The Magnesium Association, 4th Annual Meeting, Pennsylvania Hotel, New York—Oct. 30-31.

American Society for Tool Engineers, 15th Semi-Annual Meeting, Statler Hotel, Boston—Oct. 30-Nov. 1.

CHAPTER OFFICERS



Alexis Caswell
Manufacturers Ass'n of
Minneapolis, Inc.
Minneapolis
Secretary-Treasurer
Twin City Chapter



Wallace W. Levi
Lynchburg Foundry Co.
Radford, Va.
Director
Chesapeake Chapter

John F. Wakeland
Alabama Foundry Co.
Birmingham
Director
Birmingham District Chapter

H. L. Creps
Frank Foundries Corp.
Moline, Ill.
Director
Central Indiana Chapter

William J. Brown
Robert W. Bartram, Ltd.
Montreal, Que.
Director
E. Canada & Newfoundland Chapter

R. W. Trimble
Bethlehem Supply Co.
Tulsa, Okla.
Chairman
Tri-State Chapter

R. C. Woodward
Bucyrus-Erie Co.
So. Milwaukee
Secretary
Wisconsin Chapter

K. F. Schmidt
United Engineering &
Foundry Company
Canton, Ohio
Director
Canton District Chapter

Arthur H. Stenzel
Stenzel Pattern Works
Houston, Texas
Director
Texas Chapter

Arthur Green
Dake Engine Co.
Grand Haven, Mich.
Treasurer
Western Michigan Chapter

J. M. Crawford
Snyder Engineering Corp.
Los Angeles
Director
Southern California Chapter

James L. Higson
Western Iron Foundry
Denver, Colo.
Chairman
Rocky Mountain Empire Chapter

★ CHAPTER ACTIVITIES ★

news

Northeastern Ohio

REVIVAL of the annual summer outing was on the program for Northeastern Ohio chapter, July 11. Golf, swimming, indoor baseball, horseshoes, general fun and a full course dinner were scheduled for a great crowd of foundrymen and their friends at the Pine Ridge Country Club in Wickliffe, Ohio. It was the resumption of a series of outings interrupted by the war.

At the May 8 meeting the membership honored its past presidents, presenting each with a plaque. Former heads of the chapter, from 1935 through the 1946-47 season, in chronological order, are:

W. L. Woody, National Malleable & Steel Castings Co.; F. G. Steinebach, *The Foundry* magazine, both of Cleveland; B. G. Parker, Youngstown (Ohio) Foundry & Machine Co.; L. P. Robinson, Werner G. Smith Div., Archer-Daniels-Midland Co., Cleveland; E. F. Hess, Ohio Injector Co., Wadsworth; F. Ray Fleig, Smith Facing & Supply Co., Cleveland; F. J. Dost, Sterling Foundry Co., Wellington, Ohio, and H. J. Tressler, Hickman, Williams & Co.; J. G. Goldie, M.B.M. Foundry, Inc.; R. F. Lincoln, Russell F. Lincoln & Co.; A. C. Denison, Fulton Foundry & Machine Co., and H. J. Trenkamp, Ohio Foundry Co., all of Cleveland.

Tri-State

C. A. SANDERS, American Colloid Co., Chicago, was guest speaker at the technical session of the April Meeting of Tri-State chapter in the Hotel Mayo, Tulsa.

Sand practice was the topic, and Mr. Sanders presented a comprehensive discussion of proper practices, illustrating many of them with slides. The 62 members and guests took full advantage of the general discussion period.

Chapter Chairman R. W. Trimble, Bethlehem Supply Co., Tulsa, presided. He announced, at the business session, the election of a nominating committee by the present officers and directors, and the forthcoming annual meeting at which officers and directors would be elected for the coming year.

Members of the nominating group are C. C. Beagle, Webb Corp., Webb City, Mo.; F. E. Fogg, Acme Foundry & Machine Co., Coffeyville, Kansas; B. P. Glover, M. A. Bell Co., Tulsa; William Klein, Robberson Steel Co., Oklahoma City; Leo Masching, Frank Wheatley Co. and Don McArthur, Oklahoma Steel Casting Co., Tulsa, and F. R. Westwood, Service Foundry Co., Wichita, Kan.

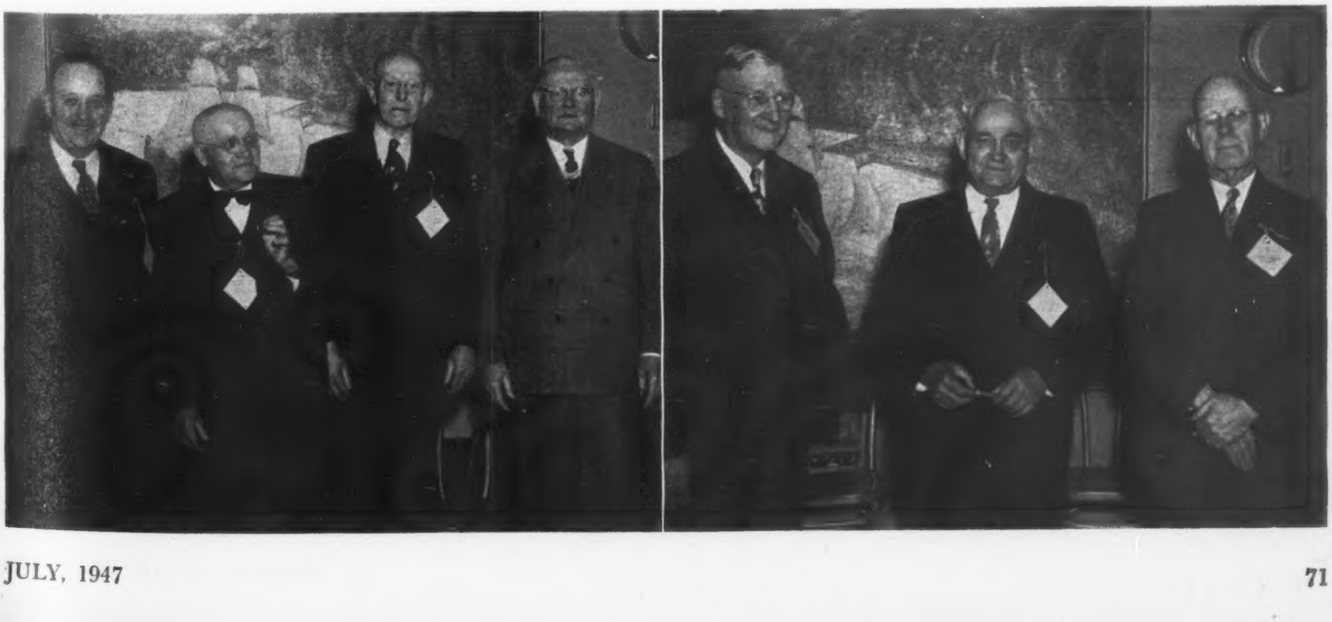
Oregon

F. A. Stephenson
Dependable Pattern Works
Chapter Secretary-Treasurer

THE JUNE MEETING of Oregon chapter, held the 19th at the Heathman Hotel, Portland, wound up the

Two groups of Old Timers present at the Wisconsin chapter party held May 9 at the Schroeder Hotel, Milwaukee.

All Wisconsin photos courtesy John Bing, A. P. Green Fire Brick Co.



Partial view of the crowd that turned out to hear H. W. Dietert, Harry W. Dietert Co., Detroit, speak at the March 28 meeting of the Tri-State chapter. Group met at the Spartan Cafeteria, Tulsa, Okla.

season with election of officers and directors to head the group for the coming year.

A. R. Prier, Oregon Brass Works, Portland, was chosen as *Chairman,* and J. O. Grant, Electric Steel Foundry, Portland, named *Vice-Chairman.*

Named *Secretary-Treasurer* was A. B. Holmes, Crawford & Doherty Foundry Co., Portland.

Directors elected to serve for three years are J. O. Grant, L. E. Holcomb, Crawford & Doherty Foundry Co., and H. K. McAllister, Western Foundry Co., all of Portland.

New England

M. A. Hosmer
Hunt-Spiller Mfg. Corp.
Association Reporter

TECHNICAL SESSION of the June 11 meeting of New England Foundrymen's Association took the form of a round table discussion of foundry problems. President D. L. Parker, General Electric Co., Lynn, Mass., served as discussion leader.

Members of his "panel of experts" were Raymond Meader, Whitin Machine Works, Whitinsville, Mass.; William Newland, New England Butt Co., Providence, R. I.; Dr. W. M. Saunders, Jr., Providence, and A. S. Wright, Hunt-Spiller Mfg. Corp., Boston.

Gating and risering of various types of castings was the problem drawing most attention during the discussions. A number of members brought to the meeting castings with which they were having difficulty, and the board members spoke on practices related to the manufacture of such castings and suggested remedies for the troubles described.

Solidification Discussed

J. B. Fifield, International Nickel Co., Hartford, Conn., also addressed the meeting. He gave the foundrymen an account of investigations on the solidification of cast iron and steel, performed at the Naval Research Laboratory, Washington, D. C., while he was there.

Hulett Speaks

The group heard M. F. Hulett, supervisor of the permanent mold department at the Elmira (N. Y.) Foundry Co., speak on "The Permanent Mold Process" at the May 14 meeting of the association in the Engineers Club, Boston.

Molds are usually cast iron, of open structure and approximately 1-in. thick, Mr. Hulett told the foundrymen. They are coated, to fill surface voids, with a mixture of China clay, sodium silicate and water, he said, adding that some foundries use carbon or soot on the mold after every cast.

Good cupola practice is a "must" for successful production of castings by the permanent mold process, the speaker declared; changes should be well distributed and the components of uniform size. The teapot ladle was recommended by Mr. Hulett, who pointed out that a minimum slag content is desired.

Other highlights of his remarks included: it is not necessary to preheat molds, but the first two rounds of castings are usually discarded;

First year students of the Montreal Technical School, Montreal, Que., were recently taken to the Dominion Engineering Works, Ltd., Lachine, Que., by the school's foundry instructors for a tour of that plant's facilities. For the past few years trips to local foundries have been arranged so that first year students can become familiar with the castings industry and be encouraged to consider the foundry as a career. These trips have been arranged by the Eastern Canada & Newfoundland chapter and through the courtesy of plant management.

molds should be pre-smoked with an acetylene flame; continuity of operation is an important factor; best temperature for the mold is 500-700 degrees F; gates should not be more than $\frac{1}{16}$-in. thick, for additional feeding, the gate should be widened.

Central New York

J. A. Feola
Crouse-Hinds Co.
Chairman, Publicity Committee

ELECTION of officers and directors of Central New York chapter was held at the annual business meeting and picnic June 13 at the Twin Ponds Golf and Country Club, Utica. Members took time out from the day's round of fun to dispose of the last business of the season.

R. A. Minnear, Ingersoll-Rand Co., Painted Post, present Vice-Chairman, was named *Chairman* and C. M. Fletcher, Fairbanks Co., Endicott, Secretary for the past year, *Vice-Chairman* for 1947-48.

J. F. Livingston, Crouse-Hinds Co., Syracuse, and David Dudgeon, Jr., Utica Radiator Corp., Utica, who complete terms as Chapter Directors this year, were chosen as *Secretary* and *Treasurer*, respectively, for next year.

Directors elected to serve for three years are A. S. Bowen, Goulds Pumps, Inc., Seneca Falls; J. F. Dobbs, New York Air Brake Co., Seneca Falls, and E. E. Hook, Dayton Oil Co., Syracuse, the retiring Chapter Chairman.

W. A. Mader, Oberdorfer Foundries, Inc., Syracuse, was elected a *Director* to complete the term of N. P. Benson, expiring in 1948.

Arrangements for the outing were handled by a committee including David Dudgeon, Jr., and E. J. Blair, Sr., of the same firm; Louis Gaetano and M. T. Fisher, Utica Steam Engine & Boiler Works, Utica; J. S. Buccolo, Utica General Jobbing Foundry, Inc., of that city, and E. H. Metzger and Murry Wheeler, International Heater Co., Utica.

(Photos courtesy John Bing, A. P. Green Fire Brick Co.)

Northern Illinois-Southern Wisconsin chapter held Old Timers Night May 13 and above are shown a few of the men honored by the chapter.

Toledo

FIFTH ANNUAL PICNIC of Toledo chapter was held June 14 at the Grey Towers in Irish Hills. It was a day of good fellowship, with games of all sorts and general merriment in the afternoon, a steak dinner and a floor show to round out the evening.

Arrangements were handled by a committee headed by Chapter Director Paul Mack, Bruce Foundry Co., Tecumseh, Mich., and Secretary-Treasurer E. E. Thompson, Unitcast Corp., Toledo, as chairmen of the outing.

Entertainment Enjoyed

L. M. Long, Leighton M. Long & Associates, Toledo, was in charge of the highly successful entertainment; games were in the province of Floyd Ensign, Multi Cast Corp., Wauseon, Ohio; N. P. Mahoney, Maumee Malleable Castings Co., Toledo; J. Moon; and Harry Schab, Bunting Brass and Bronze Company, Toledo, Ohio.

Handling the prizes were V. E. Zang, Unitcast Corp., and C. F. Carson, National Supply Co., Toledo. The vital public address system was the responsibility of N. P. Mahoney and R. E. Black, Maumee Malleable Castings Co., and F. W. Beieria, Clinton Pattern Works, Toledo, took care of transportation.

Southern California

R. R. Haley
Advance Aluminum & Brass Co.
Chairman, Publicity Committee

MODERN CUPOLA PRACTICE was the subject of T. E. Barlow, Battelle Memorial Institute, Columbus, Ohio, technical speaker at the May 7 meeting of Southern California chapter at Los Angeles.

Inspection standards have changed greatly in the past few years, Mr. Barlow pointed out. Today, standards are much higher, he said, and the importance of proper metallurgical control is underlined.

Much melting trouble, the speaker explained, is directly traceable to dirty air in cupola blowers. He recommended close supervision of filter houses and other segments of

Tom Barlow (second from left, top photograph), Battelle Memorial Institute, Columbus, Ohio, was the principal speaker at the May Southern California chapter meeting. Below—Chapter Reporter Maurice Beam (left), Los Angeles Times, greets (left to right) coffee talker Leonard Roach, Los Angeles Country Supervisor and his secretary, Miss Smith, and Chapter President-Elect H. E. Russill, Eld Metal Co.

the air system as part of good melting practice. The use of control instruments on air cleaners is not enough, since the delicate mechanisms may foul up and show faulty readings, Mr. Barlow cautioned the foundrymen. Another source of trouble is to be found in voltage input variation, resulting in inconstant air pressure, and this is difficult to control, he said.

Los Angeles County Supervisor L. J. Roach gave the coffee talk at the dinner meeting. He outlined various points of the smog-control legislation designed to eliminate smoke fog in the area.

Business Meeting Held

The annual business meeting was held prior to the technical session.

H. E. Russill, Eld Metal Co., Ltd., Los Angeles, Chapter Vice-President for the past season, was named *President* for 1947-48.

Named *Vice-President* was L. O. Hofstetter, Brumley-Donaldson Co., Los Angeles, who completed a term as Secretary this year. He is succeeded as *Secretary* by J. E. Wilson, Climax Molybdenum Corp., Los Angeles, who has served as a Chapter Director.

E. D. Shomaker, Kay-Brunner Steel Products, Inc., Alhambra, was re-elected *Chapter Treasurer.*

Directors chosen to serve for two years are A. B. Lamb, Independent Foundry Supply Co.; A. L. Goodreau, G-B Brass & Aluminum Foundry Inc.; C. E. Holmer, Kinney Iron Works, and M. B. Niesley, California Testing Laboratories, all of Los Angeles.

E. K. Smith, metallurgical consultant, Beverly Hills, was named to complete the term of J. E. Wilson, as *Chapter Director.*

The winner of the chapter's 1947 bowling team competition was announced at the meeting. Foundry Specialties Co., Los Angeles, sponsored by Walter Haggman, a former President of the chapter, carried off top honors. Team members are A. Colp, A. Greeley, D. Johnson, R. Rozelle and A. Warren.

Win Three Straight

Finishing the regular schedule in a tie with Mechanical Foundry Co., Los Angeles, the champions took the playoff with three straight wins, and then went on to defeat the winners in the second league, Alloyed Casting Co. of Los Angeles.

Bowling has become a permanent activity in the chapter program, and has resulted in financial and membership gains. Only company members of A.F.A. may sponsor teams, and players must either be members, or employed in the plant of a member company.

Western New York

Holding their annual business meeting and outing at Sturm's Grove, Buffalo, June 28, members of Western New York chapter took time out from the day's program of games and general fun to elect officers and directors.

Unanimous approval was given the slate submitted by the chapter nominating committee:

E. R. Jones, Lumen Bearing Co., Buffalo, *Chairman.*

Vice-Chairman, M. J. O'Brien, Jr., Symington-Gould Corp., Buffalo.

Secretary, F. L. Weaver, Weaver Material Service, Buffalo, and *Treasurer,* M. W. Pohlman, Pohlman Foundry Co., Inc., Buffalo.

Directors, terms expire 1950, Leonard Greenfield, Samuel Greenfield Co.; C. A. Harmon, Hanna Furnace Corp., and E. J. Roesch, American Brake Shoe Co., all of Buffalo.

Director for one year, H. C. Winte, Worthington Pump & Machinery Corp., Buffalo, retiring Chapter Chairman.

Northern California

C. R. Marshall
Chamberlain Co.
Chapter Co-Secretary

OLD TIMERS AND APPRENTICES were feted by Northern California chapter at the May 9 meeting in the Hotel Alameda, Alameda, Calif.

Henry Martens, oldest veteran in point of service present on the occasion, traced some 70 years of foundry progress in recounting his career at the request of the members and guests. Now retired, he was associated for 59 years with Enterprise Engine & Foundry Co.

Apprentice Training

A native of Germany, Mr. Martens served his four-year apprenticeship there and worked as a journeyman for two years before coming to America. In this country he added five years of experience in various jobbing shops to his industrial background prior to joining the Enterprise firm at San Francisco.

Other Enterprise veterans present included Frank Barlletanni, with 30 years of foundry service; E. J. Deckman, 27 years; Emil Anderson, Eric Anderson and Ray Miller, 24 years; Lucio Morales, 22; Mateo Rossibertolli, 21, and George Carlson and John Philipopoulous, 20 years.

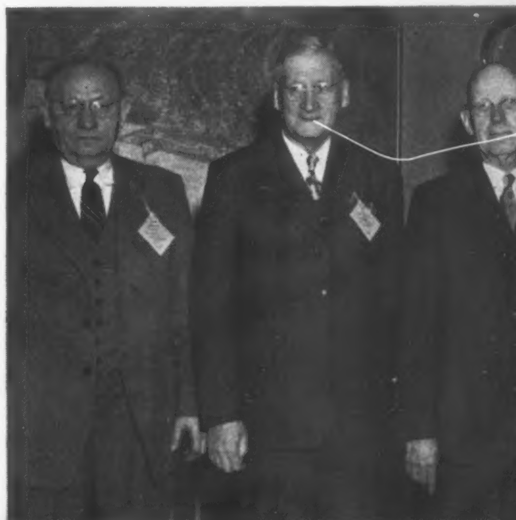
Art Allen of Lincoln Iron Foundry, San Francisco, with 48 years in the industry; Charles Johnson, H. C. Macaulay Foundry Co., Berkeley, 42 years; Alec Guild, Phoenix Iron Works, Oakland, 40 years, and Fred Williams, Empire Foundry Co., Oakland, 38 years, had some of the most distinguished records. Close behind were William Allen and Knute Palmquist of Knute Palmquist Brass, Bronze & Aluminum Foundry, Oakland, 35 and 33 years, respectively, and Harold Henderson and John Gonzales of the Macaulay firm, both with 35 years foundry background.

Also listed on the veterans' roster were Fred Hughes and John Babras, 30; James Palphini, 20; Pete Freeser, 15, and Vic Henderson, 12 years, with H. C. Macaulay Foundry Co.

Some of the apprentices, who shared the spotlight with the old timers for the evening, were called upon to present their views on apprentice training, and addressed the meeting briefly. They included Bill Skinner, Vulcan Foundry Co., Oakland, and Walter White, Phoenix Iron Works. Joe Melling of H. Macaulay Foundry Co., introduced the apprentices to the members.

At the business session the chapter nominating committee presented its recommendations for chapter officers and directors.

A. N. Ondreyco, Vulcan Foundry Co., Chapter *Vice-President,* was the



Local winners of the Wisconsin chapter's apprentice contest (bottom left) were honored as well as the Old Timers at the chapter's annual dinner, May 9, Schroeder Hotel, Milwaukee.

choice of the committee for *President* the coming season and George McDonald, H. C. Macaulay Foundry Co., for *Vice-President.*

The committee recommended the re-election of Chapter *Secretary* J. F. Aicher, E. A. Wilcox Co., San Francisco, and *Co-Secretary* Charles Marshall, Chamberlain Co., Oakland.

Nominees for *Directors* are H. M. Nystrom, Vulcan Foundry Co.; William Butts, General Metals Corp.; R. C. Wendelbo, DeSanno Foundry & Machinery Co., and J. R. Russo, General Foundry Service Corp., all of Oakland.

Saginaw Valley

F. S. Brewster
Dow Chemical Co.
Chapter Secretary-Treasurer

"Die Casting" was the technical session topic at the May 1 meeting of the Saginaw Valley chapter at Fischer's Hotel, in Frankenmuth, Michigan.

R. M. Heintz, Jack & Heintz Precision Industries, Inc., Cleveland, was the speaker of the evening. He gave the foundrymen a detailed account of methods and techniques in the production of light metal die castings, and provided an interesting exhibit of large and intricate die-cast auxiliary engine parts produced by his firm.

Prior to Mr. Heintz' talk, the chapter held its annual business meeting, at which officers and directors were elected.

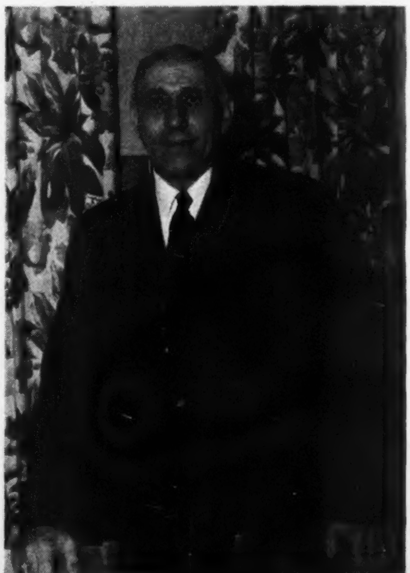
Chamberlin Chairman

M. V. Chamberlin, Dow Chemical Co., Bay City, Mich., Chapter Vice-Chairman for 1946-47, was elected *Chairman.*

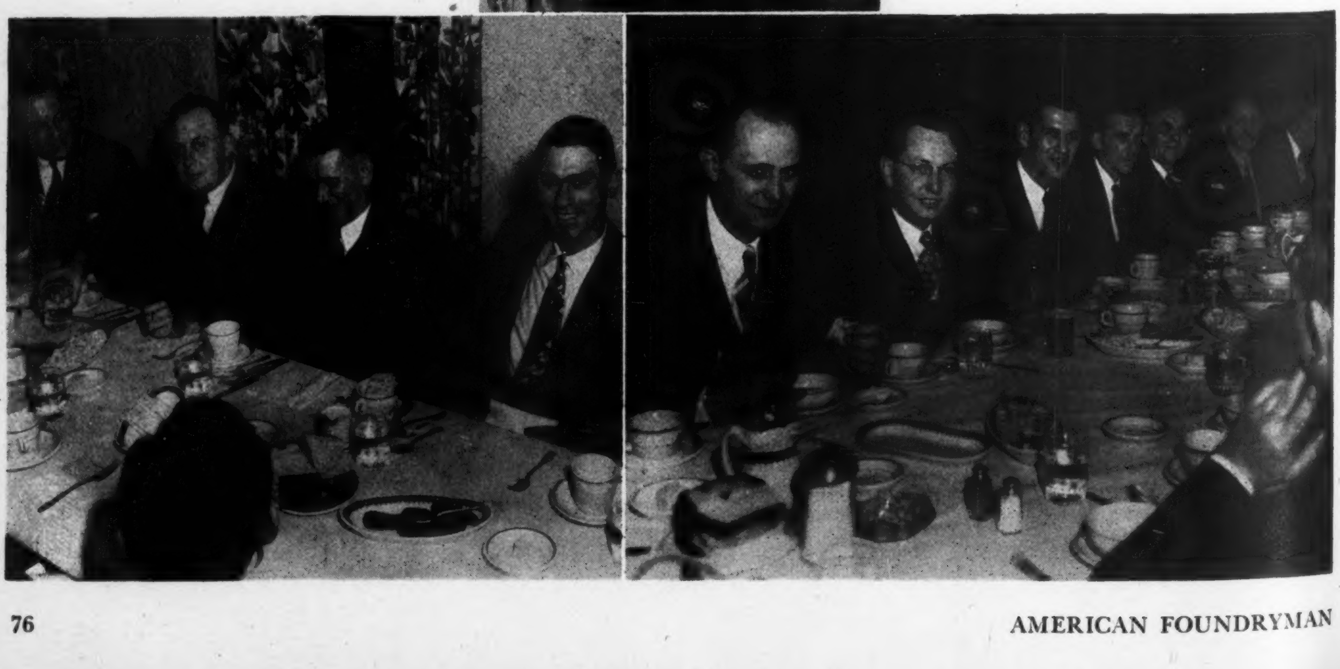
Named the new *Vice-Chairman* was O. E. Sunstedt, General Foundry & Mfg. Co., Flint, Mich., who has completed a term as Director of the Saginaw chapter.

F. S. Brewster, Dow Chemical Co., Bay City, was re-elected as Chapter *Secretary-Treasurer.*

Elected *Directors,* terms expiring in 1950, are C. A. Tobias, General Motors Institute, Flint, and H. H. Wilder, Eaton Mfg. Co., Foundry Div., Vassar, Michigan.



Top—R. M. Heintz, Jack & Heintz Precision Industries, Inc., Cleveland, speaker at the May 1 annual meeting of the Saginaw Valley chapter, held at Fischer's Hotel, Frankenmuth, Mich. Below—Members and guests of the chapter who heard Mr. Heintz speak on the subject "Die Casting."



Eastern Canada

At the May 9 meeting of the Eastern Canada and Newfoundland chapter, A. E. Cartwright, Canadian Foundry Supplies & Equipment Ltd., Montreal, who is chairman, program committee, awarded prizes to the winners of the chapter's technical paper contest. Winners were: W. P. Sullivan, Warden King Ltd., Montreal, first prize; Jas. G. Dick, Canadian Bronze Co. Ltd., Montreal, second prize; and Morris McQuiggan, Canadian Foundry Supplies & Equipment Ltd., third prize.

A committee of three, with Mr. Cartwright as chairman, judged the papers.

The titles of the three prize winning papers were: "Prevention of Shrinkage Defects by the Use of Tellurium Corewashers" by Mr. Sullivan; "Metallurgy in the Foundry" by Mr. Dick and "Some Points on the Selection and Use of Molding Machines" by Mr. McQuiggan.

Central Michigan

Fitz Coghlin, Jr.
Albion Malleable Iron Co.
Chapter Secretary-Treasurer

First official meeting of Central Michigan A.F.A. chapter drew more than 100 members and guests to the

Top left—As engrossed in C. B. Schureman's address as the members and guests of the Central Michigan chapter were the following men seated at the speakers table (left to right) C. C. Sigerfoos, Michigan State College, Lansing; J. F. Secor, Hill & Griffith Co., Cincinnati; Mr. Schureman; Chapter Chairman D. J. Strong, Foundries Materials Co., Coldwater; and Ed. Shlepp, Riverside Foundry & Galvanizing Co., Kalamazoo. Top right—Guests from the A.F.A. Michiana chapter Joe Manning, Art Pudell and Sam Denno, all of Clark Equipment Co., Buchanan. Right—Group of interested foundrymen: R. Hautman, G. Kimler, J. Ziendle and R. Pinkle, Albion Malleable Iron Co., Albion, Mich., and W. S. Walters, Hillsdale Foundry Co., Inc., Hillsdale.

Schuler Hotel in Marshall on May 20. W. B. McFerrin, Electro Metallurgical Co., Detroit, was the technical speaker.

Fundamentals of cupola operation was the topic. Mr. McFerrin stressed the importance of competent operators, who understand every phase of combustion and melting within the furnace, to satisfactory control and the necessity of constant check-up for correction of irregularities in performance. Uniform results can be obtained only through careful attention to fundamentals; establishment of the proper practice for the job, components and equipment on hand, and maintenance of rigid control once the correct method has been adopted and maintained, he told the central Michigan foundrymen.

Mr. McFerrin, who serves as Vice-Chairman of the A.F.A. Malleable Division and Co-Chairman of the Gray Iron Division committee on analysis of casting defects, was called upon to go into more detail on several aspects of his subject during the general discussion period.

Chapter Chairman D. J. Strong, Foundry Materials Co., Coldwater, presided at the business session and Secretary-Treasurer Fitz Coghlin, Jr., Albion Malleable Iron Co., Albion, served as technical chairman.

Chesapeake

J. A. Reese
Koppers Co., Inc.
Chapter Reporter

W. H. Holtz, American Brake Shoe Co., Baltimore, was named *Chairman* of Chesapeake chapter for 1947-48 at the May meeting in the Engineers Club, Baltimore, Md. He served as Vice-Chairman the past year and previously as Director.

Dr. Blake M. Loring, Naval Research Laboratory, Washington, D. C., who has been Technical Secretary since 1945, is the new *Vice-Chairman*. He is succeeded as *Technical Secretary* by W. H. Baer, Naval Research Laboratory.

L. H. Denton, Baltimore Convention Bureau, was re-elected *Secretary-Treasurer*.

Directors elected to serve for three years are Earl Gaffney, Standard Gas Equipment Corp., and J. A. Reese, American Hammered Piston Ring Div., Koppers Co., Inc., both of Baltimore, and David Tamor, American Chain & Cable Co., York, Pa., retiring Chapter Chairman.

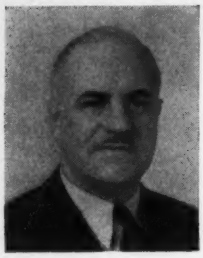
The May meeting was designated as "Equipment Night." Motion pictures of the production of cylinder blocks at the Ford Motor Co. foundry, and others illustrating modern equipment were shown at the technical session. A. L. Gardner and Victor Stine, Pangborn Corp., Baltimore, handled arrangements.

Detroit

The annual business meeting of Detroit chapter in the Rackham Educational Memorial May 15 took up the election of officers and directors as the final order of business of the chapter season.

(Continued on Page 90)

★ JULY WHO'S WHO ★



C. E. Westover

In this issue Mr. Westover presents a discussion on *Foundry Costs and Cost Controls* . . . Born in Lincoln, Neb. . . . A graduate of the State University, Lincoln in 1908 . . . Founded the Westover Foundry Co., Lincoln, Neb., during the period 1918-22 . . . From 1923-25 was foundry manager, Omaha Steel Works, Omaha, Neb. . . . During 1926 was associated with American Manganese Steel Division, American Brake Shoe Co., Denver, Colo., as plant manager . . . Appointed foundry superintendent, Otis Elevator Co., Buffalo, N. Y. (1927-29) . . . Assumed a similar position with Farrell-Cheek Steel Co., Sandusky, Ohio, 1930-34 . . . The following year (1935) became general superintendent Burnside Steel Co., Chicago . . . July, 1941, Mr. Westover assumed the position of Executive Vice-President, American Foundrymen's Association, Chicago . . . Resigning his position 1943 the author organized his own firm, Westover Engineers, Milwaukee . . . A member of A.F.A., he has contributed to its publication AMERICAN FOUNDRYMAN and a number of A.F.A. annual meetings.

L. W. Woodhouse

One of the highlights of the 7th New England Foundry Conference held recently at M.I.T., Cambridge, was the Luman S. Brown Lecture . . . The address was delivered by L. W. Woodhouse and is presented herein under the title *Making the Foundry a Good Place to Work* . . . Mr. Woodhouse was born in Coventry, England . . . A graduate of Pratt Institute, Brooklyn, he has obtained certificate as industrial mechanical engineer and safety engineer from New York and University of Connecticut, respectively . . . In 1926 was a clerk with the Hartford Fire Insurance Co., Hartford, Conn., and the following year was a test mechanic at Pratt & Whitney Aircraft Co., Hartford . . . Affiliated with the Aetna Life Insurance Co., Hartford as mechanical engineer, 1928-37 . . . Was an underwriter for Aetna Casualty & Surety Co., Hartford in 1937-41 . . . Joining the Connecticut State Department of Health, Bureau of Industrial Hygiene, Hartford, he was appointed industrial hygiene engineer . . . Was recently named principal hygiene engineer by the State Health Department . . . Has written for the trade press and been a frequent speaker before various technical societies on industrial health . . . Member of the Hartford Industrial Safety Council.

W. M. Armstrong

From a neighbor of the North comes a paper contributed by co-author William M. Armstrong who was born in Hamilton, Ont., Canada . . . Presents *Foundry Sand Reclamation*, with J. M. Cummings . . . Mr. Armstrong is a graduate of the University of Toronto (1937) . . . Immediately upon graduation joined the Steel Co. of Canada, Ltd., Hamilton and held various plant positions leading to assistant open hearth and rolling mill metallurgist . . . From 1941-43 was supervisor of metallurgical laboratories . . . Joined the Ontario Research Foundation, Toronto in 1943 and was assigned numerous ferrous and nonferrous research problems including gray iron, malleable, electric steel melting and application of statistical methods to steel foundry practice . . . From 1944-46 was awarded a research fellowship for Dominion Foundries & Steel, Ltd. . . . In 1946 was appointed a member of the British Columbia Research Council performing preliminary work on experimental foundry station and investigation of sand reclamation methods . . . At the present time co-author Armstrong is associate professor of metallurgy, University of British Columbia, Vancouver . . . Has written extensively for the trade press concerning cupola practice and quality control . . . A registered professional engineer in British Columbia . . . He is a member of A.F.A., ASM, American Society for Quality Control and Canadian Institute of Mining and Metallurgy.

H. W. Lownie, Jr.

Co-author (with D. E. Krause) of a paper on *Foundry Coke—Characteristics and Quality Factors* . . . Born in Buffalo, N.Y. . . . Attended Purdue University, Lafayette, Ind., and was graduated in 1939 with a Bachelor of Science degree in chemical engineering . . . Appointed foundry control engineer, Westinghouse Electric Corp., E. Pittsburgh . . . Obtained his Master of Science in metallurgical engineering from the University of Pittsburgh Evening School, Pittsburgh, in 1943 . . . That same year was appointed materials engineer at Westinghouse . . . Was later promoted to metallurgical engineer . . . Joined the staff at Battelle Memorial Institute, Columbus, 1945, and is a frequent contributor to metallurgical literature . . . Is a member of American Foundrymen's Association.

J. M. Cummings

J. M. Cummings is co-author with W. M. Armstrong of the article *Foundry Sand Reclamation* which appears in this issue . . . Graduated in 1933 from the University of British Columbia, Vancouver with a degree in geological engineering . . . Two years later (1935) received a Master's degree from the same university for work in minerography . . . For seven years (1936-43) was a member of the British Columbia Department of Mines, Victoria as specialist in industrial minerals . . . During the early part of World War II was working on strategic minerals . . . Was on loan to British Columbia War Metals Research Board to supervise research on strategic minerals (1942-44) . . . In 1944 was a member of British Columbia Research Council . . . During 1945 was acting head of Division of Mining and Metallurgy, British Columbia Research Council . . . At present is affiliated with the Bureau of Mines as resident mining engineer in Vancouver, specializing in the development of industrial minerals throughout the British Columbia Province . . . A member of American Society for Metals and CIMM.

Mr. Shuffstall was born in Franklin, Pa. . . . Has attended extension classes sponsored by the Pennsylvania State College at Erie, Pa., in relation to metallurgical and mechanical engineering . . . Began his 24 year affiliation with the National Erie Corp., Erie, Pa., as a patternmaker apprentice . . . Following completion of this course in 1927 he was made patternmaker foreman . . . Five years later (1932) he was named chief inspector and in 1935 held various positions in the foundry department . . . He was appointed production manager in 1937 and assumed his present position as assistant plant manager in 1939 . . . His article *Flame Gouging Steel Castings* appears herein.

J. A. Shuffstall

D. E. Krause

D. E. Krause, co-author with H. W. Lownie, Jr., of the article that appears in this issue *Foundry Coke—Characteristics and Quality Factors* is a member of the supervisory staff of the division of foundry technology, Battelle Memorial Institute, Columbus . . . Mr. Krause holds Bachelor of Science and Master of Science degrees from the University of Wisconsin, Madison . . . Before joining the Battelle staff in 1932 he was a chemist and metallurgist for the Brillion Iron Works, Brillion, Wis. . . . Mr. Krause has been associated with a number of metallurgical developments and he holds seven U. S. patents.

On March 20 the author presented before the Oregon chapter a paper on plastics as applied to the foundry and pattern industry . . . In this issue on page 26 the paper is referred to as *Making Plastic Patterns* . . . 54 years of age, Mr. McAfee comes from a family steeped in the tradition of the iron foundry . . . Most of the members are molders . . . The author turned to the patternmaking field and learned his trade in Portland, Oregon . . . Prior to World War I he became associated with the Puget Sound Naval Shipyard as a patternmaker and has remained there . . . In 1938 he received the appointment as master patternmaker . . . He is a member of A.F.A.

E. J. McAfee

A.F.A. CHAPTER DIRECTORY

BIRMINGHAM DISTRICT CHAPTER
Secretary-Treasurer—Fred K. Brown, Adams, Rowe & Norman, Inc., 729 Brown-Marx Building, Birmingham, Ala.

BRITISH COLUMBIA CHAPTER
Secretary-Treasurer—L. P. Young, A-1 Steel & Iron, Foundry Ltd., Vancouver.

CANTON DISTRICT CHAPTER
Secretary—C. B. Williams, Massillon Steel Castings Co., Massillon, Ohio.

CENTRAL ILLINOIS CHAPTER
Secretary—George H. Rockwell, Caterpillar Tractor Co., Peoria, Ill.

CENTRAL INDIANA CHAPTER
Secretary—Robert Langsenkamp, Langsenkamp-Wheeler Brass Works, 1234 Shelby Ave., Indianapolis.

CENTRAL MICHIGAN
Secretary-Treasurer—Fitz Coghlin, Jr., Albion Malleable Iron Co., Albion.

38

CENTRAL NEW YORK CHAPTER
Secretary—C. M. Fletcher, 111 Prospect St., Endicott, N. Y.

CENTRAL OHIO CHAPTER
Secretary—Karol Whitlatch, 439 Richardson Ave., Columbus, Ohio.

CHESAPEAKE CHAPTER
Secretary-Treasurer—L. H. Denton, Baltimore Convention Bureau, 1714 O'Sullivan Building, Baltimore 2, Md.

CHICAGO CHAPTER
Secretary—John C. Lunkes, Velsicol Corp., 120 E. Pearson St., Chicago, Ill.

CINCINNATI DISTRICT CHAPTER
Secretary—Earl F. Kindinger, Williams & Co., Inc. 1921 Dunlap, Cincinnati 14, Ohio.

DETROIT CHAPTER
Secretary—R. E. Cleland, Eastern Clay Products, Inc., 510 United Artists Building, Detroit 26.

EASTERN CANADA AND NEWFOUNDLAND CHAPTER
Secretary—Robert E. Cameron, 257 Metcalf Ave., Westmount, Que., Canada.

METROPOLITAN CHAPTER
Secretary—J. F. Bauer, Hickman, Williams Co., 70 Pine St., New York 5.

MEXICO CITY CHAPTER
Secretary—N. S. Covacevich, Casa Covacevich Foundry Supplies & Equipment, Mexico City, D. F., Mexico.

MICHIANA CHAPTER
Secretary—V. S. Spears, American Foundry Equipment Co., 2013 Linden Ave., Mishawaka, Ind.

NORTHEASTERN OHIO CHAPTER
Secretary—Gilbert J. Nock, Nock Fire Brick Co., 1243 E. 55th St., Cleveland 14.

NORTHERN CALIFORNIA CHAPTER
Secretary—J. Fred Aicher, 116 New Montgomery St., 339 Rialto Building, San Francisco 5.

NORTHERN ILLINOIS-SOUTHERN WISCONSIN CHAPTER
Secretary—Herb Bauman, Ebaloy, Inc., Rockford, Ill.

NORTHWESTERN PENNSYLVANIA CHAPTER
Secretary—Harry L. Gebhardt, United Oil Mfg. Co., 232 W. 21st St., Erie, Pa.

ONTARIO CHAPTER
Secretary—G. L. White, Westman Publications, Ltd., 137 Wellington St., Toronto, Ont., Canada.

OREGON CHAPTER
Secretary—F. A. Stephenson, Dependable Pattern Works, 1634 S.E. 7th Ave., Portland 14, Ore.

PHILADELPHIA CHAPTER
Secretary-Treasurer—W. B. Coleman, W. B. Coleman Co., 9th & Rising Sun Ave., Philadelphia 40.

QUAD CITY CHAPTER
Secretary-Treasurer—Ray Marthens, Marthens Co., 1205 4th Ave., Moline, Ill.

ROCHESTER CHAPTER
Secretary-Treasurer—Leon C. Kimpal, Rochester Gas & Electric Corp., 89 East Ave., Rochester 4, N. Y.

ROCKY MOUNTAIN EMPIRE CHAPTER
Secretary—Chas. E. Stull, Manufacturers Foundry Corp., Denver, Colo.

SAGINAW VALLEY CHAPTER
Secretary-Treasurer—F. S. Brewster, 2008 Third St., Bay City, Mich.

ST. LOUIS DISTRICT CHAPTER
Secretary—Robert E. Woods, Warren Coke Co., 607 Laclede Building, St. Louis 1.

SOUTHERN CALIFORNIA CHAPTER
Secretary—L. O. Hoffstetter, Brumley-Donaldson Co., Box 336, Vernon Station, Los Angeles 11.

TEXAS CHAPTER
Secretary-Treasurer—H. L. Wren, 629 M & M Building, Houston, 2.

TOLEDO CHAPTER
Secretary-Treasurer—Emmett E. Thompson, 1723 Perth St., Toledo, Ohio.

TRI-STATE CHAPTER
Secretary—Charles A. McNamara, Jr., Big Four Foundry Co., Inc., 621 East Cameron, Tulsa, Okla.

TWIN CITY CHAPTER
Secretary-Treasurer—Alexis Caswell, Manufacturers' Association of Minneapolis, Inc., 100 Metropolitan Building, Minneapolis 2.

UNIVERSITY OF MINNESOTA STUDENT CHAPTER

WASHINGTON CHAPTER
Secretary-Treasurer—A. D. Cummings, Western Foundry Sand Co., Seattle.

WESTERN MICHIGAN CHAPTER
Secretary—V. A. Pyle, Pyle Pattern & Mfg. Co., 1201 Sanford St., Muskegon Heights, Mich.

WESTERN NEW YORK CHAPTER
Secretary—Leo A. Merryman, Tonawanda Iron Corp., Box 198, N. Tonawanda, N. Y.

WISCONSIN CHAPTER
Secretary—Robert C. Woodward, Bucyrus-Erie Co., So. Milwaukee, Wis.

NEW FOUNDRY LITERATURE

In a new 12-page illustrated bulletin, Allis Chalmers Mfg. Co., Milwaukee 1, describes its sealed "Unitop" oil circuit breakers, frame-mounted outdoor units equipped with the "Ruptor" interrupting device and known as "Type FZO-150."

Design and operation of "Rotoblast" airless blast cleaning units are explained in the new Bulletin No. 214, released by Pangborn Corp., Hagerstown, Md. The engineering principle involved is illustrated through diagrams and photographs, and case studies of performance and typical applications are included. The "inside story" of cleaning, with abrasive applied by centrifugal force, is presented in a step-by-step description of the unit's operation.

In the January-February issue of Walworth Today, published by Walworth Co., 60 East 42nd St., New York, complete details on the firm's bronze and pressure-seal valves are provided.

A descriptive folder relating to the various types of cutters manufactured by the Cadillac Cutter Co., 1613 Eastern Ave., S.E., Grand Rapids, Mich., is available upon request.

Motor maintenance tools, such as commutator and slip ring resurfacing stones; polishing stones; blowers and vacuum cleaners for removing dust and lint from motor windings; a varnish insulation sprayer; voltage and circuit testers, and 14 types of wire insulation strippers, are described in a 10-page illustrated catalog published by Holub Industries, Inc., Sycamore, Ill.

Eberbach & Son Co., Ann Arbor, Mich., offer a review of new developments in laboratory apparatus and process control equipment in its publication, "Announcer of Scientific Equipment."

Complete data on air line respirators and auxiliary parts and equipment made by Mine Safety Appliances Co., Braddock, Thomas & Meade Sts., Pittsburgh 8, is contained in a 4-page Bulletin No. CS-23. Available upon request from the above firm.

Details of the Mine Safety Appliance Oxygen Therapy Unit are given in Bulletin No. CW-2 recently released by the above company. Self-contained and readily portable, weighing less than 6 lb., the unit is designed for oxygen treatments by plant physicians in dispensaries, hospitals, or on emergency calls. Bulletins can be obtained from Mine Safety Appliances Co., Braddock, Thomas & Meade Sts., Pittsburgh 8.

Background and development of the modern analytical balance, an essential tool in the scientific laboratory, are detailed in the March issue, Announcer of Scientific Equipment, published by Eberbach & Son Co., Ann Arbor, Mich. A new electro-analysis apparatus, embodying improvements in design and components, is also described.

Latest developments in "Aristo Craft" power tools are described and illustrated in Catalog No. 1, issued by Aristo Power Tools, Inc., 601 W. Washington Blvd., Chicago 6. The firm's complete line of power drills is featured; also a 27-ounce air gun that may be used as a hammer, chisel, molding or marking tool; and four models of power blowers which can be converted into suction cleaners.

More than 150 products of Bristol Co., Waterbury 91, Conn., including recording thermometers, pyrometers, pressure gages, voltmeters, ammeters, pH recorders and accessories, are listed in Bulletin No. W 1811, just released.

"Rex" steel fabricated and cast chains are illustrated and described in a new bulletin, No. 46-10, issued by Chain Belt Co., 1600 W. Bruce St., Milwaukee 4. Three pages of installation photographs are included; standard attachments are shown, and information on cast and cut tooth sprockets is included.

Heating, ventilating and air conditioning equipment, including V-belt drives, centrifugal pumps, motors and motor controls and welders, are listed and shown in the new, 12-page Bulletin 25B6183, issued by Allis Chalmers Mfg. Co., Milwaukee 1.

American Air Filter Co., 215 Central Ave., Louisville 8, Ky., has published a new, 19-page illustrated booklet describing its "Type D Roto-Clone" dynamic precipitator. This unit will collect practically every type of industrial dust. Illustrations provide detail view of components. Capacity and dimension tables for several size precipitators are given.

In an 8-page bulletin, Whiting Corp., Harvey, Ill., describes its new line of electric chain hoists. Complete specifications, operation data and prices are given. Ask for Bulletin No. H-100-A.

Information on the completely redesigned "Di-Acro Brake" is included in the new 40-page catalog, No. 46-11, "The Di-Acro System of Die-Less Duplicating," published by O'Neil-Irwin Mfg. Co., Lake City, Minn., and also describing other recent developments incorporated in the firm line of precision machines.

Construction and operation details and industrial application of "M.S.A. Hose Masks," designed for protection of workers where high concentrations of gas or insufficient oxygen exist, are contained in a new bulletin, EB-5, released by Mine Safety Appliances Co., Braddock, Thomas and Meade Sts., Pittsburgh 8, Pa., which also offer new bulletins, DK-13 and DR-3, respectively, on the "M.S.A. Skullgard" for protection against head injuries, and the "M.S.A. Carbon Monoxide Air Alarm," which gives audible and visible warning when concentration reaches a predetermined level.

Sources of information on photo-templates and photolofting, photodials, name and instruction plates, and photogrid printing, are included in a new bibliography of articles and books on industrial photoreproduction, now available from the industrial photographic sales division of Eastman Kodak Co., 343 State St., Rochester 4, N. Y. In another bibliography on spectrography, the firm offers a 16-page booklet listing articles and books covering the broader aspects of chemical spectrography; equipment and supplies; flash, infra-red and mass spectrography; radiation sources and "Raman Effect" and ultraviolet spectrography.

"DC Silicones," manufactured by Dow Corning Corp., Midland, Mich., are described in the recently released catalog, "Dow Corning Silicones, New Engineering Materials." All silicone products available from the firm are listed, and properties of the family of organo-silicon-oxide ploymers are described through numerous charts and graphs.

Thermo Electric Mfg. Co., 474 Locust St., Dubuque, Iowa, will furnish a bulletin describing their new model electric furnace.

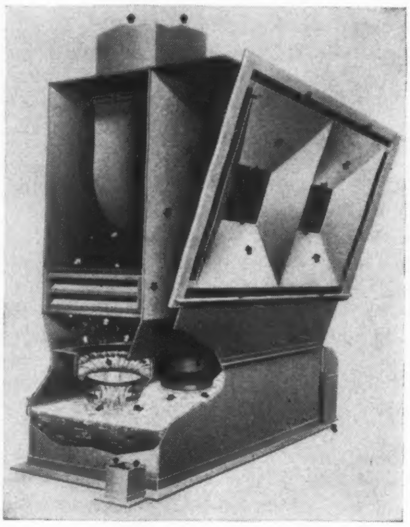
Bulletin No. 10 can be obtained from Manco Mfg. Co., Bradley, Ill., concerning a new Carolus type cutter.

Mechanized equipment for the foundry, designed to produce better, lower cost castings and suitable for applications ranging from heavy jobbing to mass production, is described in "Foundry Mechanization," a new 20-page booklet available from Allis-Chalmers Mfg. Co., Milwaukee 1. Shakeouts, sand conditioning and reclaiming machinery, motors, drives, controls, cupola blowers and mercury arc converters, are included in the line discussed in the booklet, Bulletin No. 07B6092A. In another new publication, Bulletin 25B6150, titled "More Power to U.S.A.," the firm presents its equipment for power generation and transmission, including blowers, compressors, auxiliary motors, switch gear and power transformers.

NEW FOUNDRY PRODUCTS

Air Cleaner

Newcomb-Detroit Co., 5741 Russell St., Detroit, announces the Uni-Wash Shake-Out Booth which is a self-contained unit complete with intake hood, air cleansing process and exhaust fan. Available in five standard sizes these units may be used to collect dust from shake-out, core knock-out, shaker screen, sand transfer, mold conveyor and pouring operations. Air is drawn into the booth and down the duct in the front to the wash process. It is given a multiple wash as it passes through and into moisture separators; and is distributed by the built-in discharge fan. Dirt collected from the air is in the form of wet sludge in the water tank in the bottom of the booth. An automatic sludge conveyor carries the sludge to the discharge point. Clean-out of the tank can be done easily through large doors in the rear of the unit.

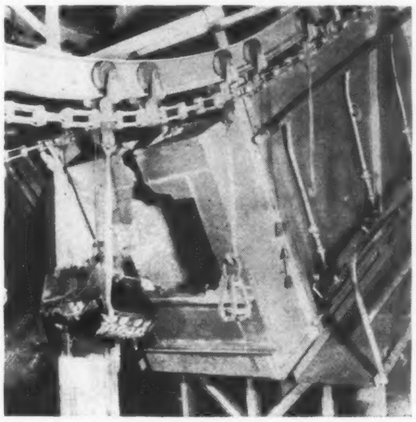


Slide Rule

Burrell Technical Supply Co., 1936 Fifth Ave., Pittsburgh, features a slide rule of metal body construction with black and white scales. Incorporated are the following features: the log scales all refer to a single D scale and have a greater range of direct reading; powers (including those of base e) with both positive and negative exponents can be read with one setting of the hairline; reciprocals can be read with the decimal point placed; square root scale is double the length of the C scale; cube root scale is triple the length of the C scale and numerous other advantages. Scales include tangent of angles 5.70 to 83°; squares and square roots (20-in. scale); cubes and cube roots (30-in. scale) and many others.

Oxygen Unit

Mine Safety Appliances Co., Pittsburgh, has designed a self-contained and readily portable oxygen unit for oxygen treatments by plant physicians in dispensaries, hospitals, or emergency calls. Provided with an oxygen regulator and reducing valve it supplies a flow of oxygen from any cylinder, through a flexible hose, to a face-piece with positive-acting check valves for inhalation and exhalation. Air mixing valve provides a means for automatically mixing in amounts of 40, 60 or 80 per cent outside air with oxygen desired. Sturdy carrying case for transporting is included.



Stress Relieving Furnace

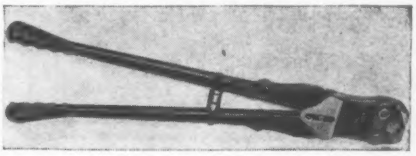
Bellevue Industrial Furnace Co., 2971 Bellevue Ave., Detroit 7, has designed a continuous furnace for relieving stresses. Inside dimensions are 3 ft. wide by 4 ft. 9-in. high by 70 ft. long. It is gas fired with forty pressure type burners. Walls are 9-in. thick, consisting of 4½-in. of 2300 F. insulating refractory, backed up with 4½-in. of 2000 F. insulating brick. Two heat zones are automatically controlled by a potentiometer. Casing consists of steel plate all properly reinforced with structural steel shapes. Bottom of the furnace is designed with four cleanout doors for the removal of sand, a catwalk running the full length on both sides of the furnace and side doors give access to its interior for servicing purposes.

Electro-Analysis

Eberbach & Son Co., Ann Arbor, Mich., present an apparatus for determining nickel, copper, lead, antimony, cadmium, zinc, chromium and other metals. A built-in selenium dry type full wave rectifier delivers 8 volts, 5 amperes DC at both spindles for simultaneous determinations or 10 amperes DC for a single determination. Stirrer rotate at constant speed of 550 rpm. Rubber cushioned beaker supports may be raised or lowered for various size beakers.

Crane Control

General Electric Co., Schenectady, N. Y., is producing a pendant pull station control designed specifically for floor-operated cranes. Furnished for use on alternating or direct current with motors up to 15 hp. at 220 volts, the new system can be used on simple hoists to three-motion bridges. System consists of small magnetic control panel mounted on the crane and station has one handle for each direction of crane motion. Emergency stop button instantly cuts off power from crane motors and is one of the protective features.



Cutter

Manco Mfg. Co., Bradley, Ill., has announced a new type cutter that features two way cutting jaw providing both sides and end cutting action. End cut allows operator to cut bolts in hard to get at places. Also available in a 3 way combination incorporating a nut splitter.

Time Controller

Bristol Co., Waterbury 91, Conn., has developed a multiple-cam time cycle controller for timing mechanical operations in industrial processes. Model C500 Impulse-Sequence Cycle Controller is an instrument designed where a number of factors, such as the opening and closing of valves, switches, dampers, retorts, and presses, and blowers, must be timed according to a fixed program. Timing is accomplished by a telechron-driven aluminum disc on which is a printed 25-in. time scale. The desired schedule of operations is incorporated into the controller by cutting notches with a notching punch on the time scale. Location of punches determines time operation of cam mechanism. Time impulses are transmitted electrically.

Indexing Table

Kaukauna Machine Corp., Kaukauna, Wis., has developed an indexing table that can be used for inspection or lay out work. Main bed is cast iron construction, designed and built to support heavy workpieces without deflection. T-slots are provided in the top and at each end for clamping purposes. Center of the main bed contains a 36-in. diameter indexing platen of cast iron supported by an extra capacity ball thrust bearing. Positive indexing positions are obtained through a hardened steel plunger and hardened steel bushings. The platen also contains T-slots for clamping work.

Dollies

Techtmann Industries, 714 W. Wisconsin Ave., Milwaukee, announce the development of a new five ton model dolly with adjustable connecting bar for lighter loads. Is 15¼-in. by 6⅛-in. by 4-in. high with 3⅝-in. diameter solid steel rollers. Roller bearings lubricated with fittings. Extension bar telescopes inside iron bar. Minimum span of pair of dollies with extension bar is 36-in. overall—maximum 56-in. Steel cleats bite into wood skids, preventing slipping or shifting of load.

Gage

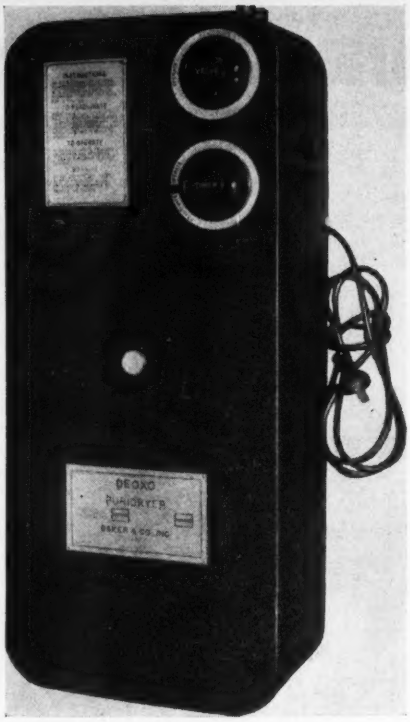
Circle Gauge Co., 4750 York Blvd., Los Angeles, present a "ring-mike" designed for use in automotive trade in sizing piston rings. It offers a quick, convenient and accurate way of gaging circular pieces or parts. A ring cannot be accurately measured when the center line of the ring changes with each size ring. This instrument draws the ring to be measured into an angle, instead of against a pin, which causes all rings to be measured on the same center line, which insures an accurate measurement on all sizes of rings. Readings are made on the dial through a magnifying glass in both decimals and fractions.

Fire Extinguisher

Ansul Chemical Co., Marinette, Wis., displayed its new "Ansul-Dugas" dry chemical fire extinguisher at the recent National Safety show in Chicago. Of greatly increased fire-stopping power, it is designed for simplified, faster operation; quicker, easier on-the-spot recharge; greater heat shielding protection for the operator, and greater capacity without increase in weight. Listed and approved by the Underwriters' Laboratories and Factory Mutual Laboratories.

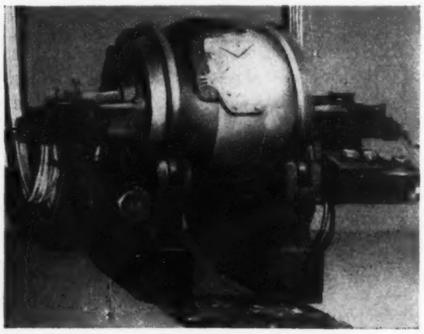
Spiral Cutters

Cadillac Cutter Co., 1613 Eastern Ave., S.E., Grand Rapids 7, Mich., announce a complete line of H.H.S. tapered spiral cutters. These range in size from ½° to 7° taper per side, ½-in. to 3½-in. flutes, and small end diameters from 3/32-in. to ½-in. Suited for machining all types of dies, molds and patterns, standard design features include a straight shank with flats for easy insertion in set screw holders, uniform hook rake, R.H. cut, R.H. spiral and three flutes to minimize chatter and provide added strength.



Purifier

Baker & Co., Inc., Newark 5, N. J., has introduced an automatic device which removes oxygen impurities and eliminates moisture from gases. Called the Deoxo Puridryer it can be installed at any convenient point on the low pressure line, the instrument purifies such gases as hydrogen so that less than one part in a million of oxygen impurities remains, and then dries the gas to dew points of better than -50 F. Also used with such gases as nitrogren, argon, neon and saturated hydrocarbons. Unit is encased in a black wrinkle-finish housing, upon which are two operating dials and a green pilot light.



Electric Furnace

Detroit Electric Furnace Div., Kuhlman Electric Co., Bay City, Mich., announce the addition of a new indirect arc rocking electric furnace which will melt up to 900 lb. of bronze or 500 lb. of cast iron per hour. Known as type LFN and rated 150 Kw. with 500 lb. nominal cold charge capacity, has Detroit rocking action. Available with attached electrode brackets and mechanical automatic electrode control, or pedestal mounted electrode brackets with automatic hydraulic control as illustrated.

Lathe Grinding Attachment

South Bend Lathe Works, 91 E. Madison St., South Bend 22, Ind., has developed a electric grinding attachment for precision, external grinding of lathes and other machine tools. Grinding wheel spindle runs on pre-lubricated, sealed precision ball bearings. Tension adjustment is provided for the V-belt connecting the ¼ h.p. motor with the wheel spindle. Wheels are available in various grades for grinding iron, steel, non-ferrous metals and non-metallic materials.

Lathe and Wheel Guard

Standard Safety Equipment Co., 323 W. Ontario St., Chicago, has announced the "Stasafe Chip Guard," for use with lathes, grinding wheels, shapers, and other machines. Designed to permit over-all inspection of the work at the point of operation, the guard is constructed with a strong, all-metal frame, equipped with a curved, replaceable plastic window, and may be set at any angle or moved laterally when in place through a universal attachment at the base.

Safety Switch

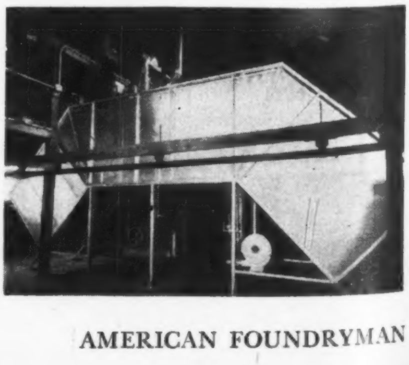
The Electric Controller & Mfg. Co., Cleveland, present for use in outdoor applications, and other locations where adverse weather conditions prevail, a weatherproof safety switch; exceptionally compact and of rain-tight and dust-tight construction. Enclosures are heavy gage steel with aluminum finish and have slanted roof with drip-trough over the front door. A heavy sponge rubber gasket makes a tight seal between the box and the door. Switch-mechanism is fully interlocked to prevent opening the door with the switch in the "on" position.

Hydrosulphosol

Rees-Davis Drugs, Inc., 39 Charles St., Meriden, Conn., announce a fast-healing remedy for the treatment of first, second and third degree burns and x-ray burns called hydrosulphosol. A safe non-toxic remedy for burns of all types and makes non-scarring possible by aiding in the rapid growth of new tissue.

Rust Proofer

Burdett Mfg. Co., 3433 W. Madison St., Chicago, have developed an infra-red burn-off rust proofing process. By proper placing gas-fired infra-red burners in relation to the work, as determined by scientific standards, this process produces a blue surface on the metal that is rust resistant.



Annual Chapter Chairman Conference

(Continued from Page 25)

Secretary-Treasurer L. C. Fill, foundry superintendent, George D. Roper Corp., Rockford.

Northwestern Pennsylvania—Chairman J. W. Clarke, assistant superintendent of foundries, General Electric Co., Erie.

Ontario—Chairman James Dalby, manager, Wilson Brass & Aluminum Foundries, Toronto, Ont.

Oregon—Chairman A. R. Prier, manager, Oregon Brass Works, Portland.

Philadelphia—Chairman E. C. Troy, vice-president, Research and Development Div., Dodge Steel Co., Philadelphia.

Quad City—Chairman R. H. Swartz, general manager, Riverside Foundry Co., Bettendorf, Iowa.

Rochester—President L. C. Gleason, foundry engineer, Gleason Works, Rochester, N. Y.

Rocky Mountain Empire—Treasurer, J. W. Horner, Jr., vice-president, Slack-Horner Brass Mfg. Co., Denver, Colo.

Saginaw Valley—Chairman M. V. Chamberlin, metallurgist, Dow Chemical Co., Bay City, Mich.

Vice-Chairman O. E. Sundstedt, vice-president and general manager, General Foundry & Mfg. Co., Flint, Mich.

St. Louis—Chairman N. L. Peukert, supervisor, Carondolet Foundry Co., St. Louis.

Secretary P. E. Retzlaff asst. supt., Busch-Sulzer Diesel Engineering Co., St. Louis.

Southern California—President H. E. Russill, vice-president, Eld Metal Co., Los Angeles.

Texas—Chairman M. W. Williams, foundry manager, Hughes Tool Co., Houston.

Tri-State—Chairman R. W. Trimble, foundry superintendent, Bethlehem Supply Co., Tulsa, Okla.

Twin City—Chairman S. P. Pufahl, president, Pufahl Foundry, Inc., Minneapolis.

Washington—Chairman C. M. Anderson, vice-president, Eagle Brass Works, Seattle.

Western Michigan—Chairman C. H. Cousineau, metallurgist, West Michigan Steel Foundry Co., Muskegon.

Western New York—Chairman E. R. Jones, plant superintendent, Lumen Bearing Co., Buffalo.

Vice-chairman M. J. O'Brien, Jr., assistant works manager, Symington-Gould Corp., Depew.

Wisconsin—President R. J. Anderson, works manager, Belle City Malleable Iron Co., Racine.

The three-day conference opened on Monday, June 30 with fifty people in attendance, including National Officers and Directors and members of the National Staff. This was the first time in the history of this annual meeting that three days were devoted to the Chapter Chairman Conference. Previous meetings have either been one and a half or two days in length.

In his welcoming address President Wood stated that this meeting afforded the opportunity for chapter chairmen to meet each other and express ideas as well as to learn more about the workings and functions of the Association. Following President Wood's words of welcome the chapter chairmen were asked to stand and introduce themselves and then President Wood was called on again for a brief outline and historical review of American Foundrymen's Association.

The remainder of the morning was spent discussing the technical activities of the Association. Technical Director S. C. Massari told how the technical committees were organized and functioned, the number of research programs under way and those that are contemplated, and stressed how the technical activities of the Association can be integrated with and for the benefit of the chapters.

A description of the A.F.A. publication program was also presented so as to acquaint chapter officers and delegates with A.F.A. literature now available and publications being planned for the immediate future. The officials were also informed how technical publications are prepared and their importance to the membership.

The afternoon session was devoted to the progress and plans for AMERICAN FOUNDRYMAN. President Wood, Vice-President Kuniansky, and Conference Chairman Wallis all commented briefly on the magazine and its place in Association activities. A number of suggestions for the improvement of the magazine were made from the floor by those in attendance.

Vice-President Kuniansky led the discussion on chapter program building and drew on the experience of visiting chairmen in conducting their own programs and developing means of improving programs for the coming year. A number of delegates reported on how special events created local interest.

"So You Think You're Slipping" was the title of E. A. McFaul's talk delivered at the conference dinner held Monday evening. Mr. McFaul, who is connected with De Paul University, Chicago, listed a few of man's "normal abnormalities" and presented them in a humorous light as he illustrated how they occur in the lives of practically everyone.

Tuesday morning's program was devoted entirely to a panel discussion of chapter operations. Conference Chairman Wallis acted as the moderator and other members of the panel included President Wood, National Director Smith, Secretary Maloney and Technical Director Massari.

National Director G. K. Dreher, newly appointed Executive Director, Foundry Educational Foundation, spoke before the group at the luncheon held Tuesday. Mr. Dreher outlined the plans of the Foundation and discussed its functions.

A.F.A. Educational Program

Of particular interest to the 44 chapter delegates was the session devoted to the educational program of A.F.A., headed by H. F. Scobie, Educational Director. He discussed the apprentice training contest and youth encouragement program. He emphasized the need for integration of the national educational program with the local chapter educational committees. Going still further it was told how the chapter educational activities can best function to benefit their local foundries and local community. Some of the work which has been accomplished by these committees was explained.

Secretary-Treasurer Maloney discussed how the Association is budgeted and financed and from where the A.F.A. income eminates. He also told how this income is returned to the industry through divisional research projects and various other means.

Wednesday morning the chairmen heard Harold Hauslein, Harold Hauslein & Associates, Chicago, discuss how to handle a meeting. He covered a number of points in his presentation which are important to chapter chairmen.

To add to the knowledge of conducting their evening sessions the heads of the chapters listened to G. N. Sieger talk on "How to Run a Meeting."

PERSONALITIES

(*Continued from Page 67*)

Construction Co., Inc., New York, as assistant chief engineer of the rolling mill division. He has spent more than 35 years as engineer in the steel industry.

Obituaries

Henry Mueller, president and treasurer of Spring City Pattern Works, Inc., Waukesha, Wis., died May 31 at his home in Milwaukee. He was 57.

Associated with the firm since 1919, when he acquired an interest, Mr. Mueller was active in its direction until 1942, in which year he became ill. He was an active member of A.F.A. and was affiliated with Wisconsin chapter.

L. W. Kempf

Louis W. Kempf, assistant director of research for Aluminum Research Laboratories, Cleveland, died in Cleveland June 14 after an extended illness.

A native of Luther, Mich., Mr. Kempf obtained his early education in Michigan public schools and acquired industrial background with Continental Motors, Studebaker Corp. and Dodge Motor Co. He earned his bachelor and master of science degrees at the University of Michigan, Ann Arbor.

In 1924 he joined Aluminum Co. of America as research metallurgist. Mr. Kempf was placed in charge of the Cleveland metallurgical division of Aluminum Research Laboratories six years later; named manager of the Cleveland branch of the laboratories in 1943, and assistant director of research two years ago.

He was a member of A.F.A. with the Northeastern Ohio chapter, and also held membership in the AIME, ASM, ASTM and British Institute of Metals.

Charles F. Dishaw, former owner of the Dishaw & Dishaw Foundry, Canton, N. Y., died at his home in Syracuse recently after an extended illness.

He had moved to Syracuse about five years ago and, prior to his retirement due to ill health last year, was associated with Oberdorfer Foundries there.

Elmer R. Gilbert, president of the Freeman Supply Co., Toledo, Ohio, died May 14 after an illness of one year.

(*Concluded on Page 87*)

PERSONALITIES

(Continued from Page 84)

President of the Freeman firm for the last 24 years, he had been with that company for 30 years. Mr. Gilbert was an active member of Toledo A.F.A. chapter.

Albert C. Wishmeyer, president and treasurer of Nunn Brass Works and treasurer of K. Barthelmes Mfg. Co., Inc., both of Rochester, N. Y., died recently at the age of 51.

Thomas S. Hemenway, president and founder of Metal & Alloy Specialties Co., Buffalo. N. Y., died May 25 at the age of sixty-five.

Native of Auburn, N. Y., Mr. Hemenway was graduated by Pritchett College, Glasgow, Mo., in 1901, and later attended Purdue University, Lafayette, Ind., where he received a degree in engineering.

He established the Metal & Alloy firm in 1916. At the time of his death, he had been engaged in engineering activities for more than 40 years.

One of the organizers of the Non-ferrous Founders' Society, Mr. Hemenway was serving as its fourth president. He was also one of the most active supporters of Western New York chapter, A.F.A.

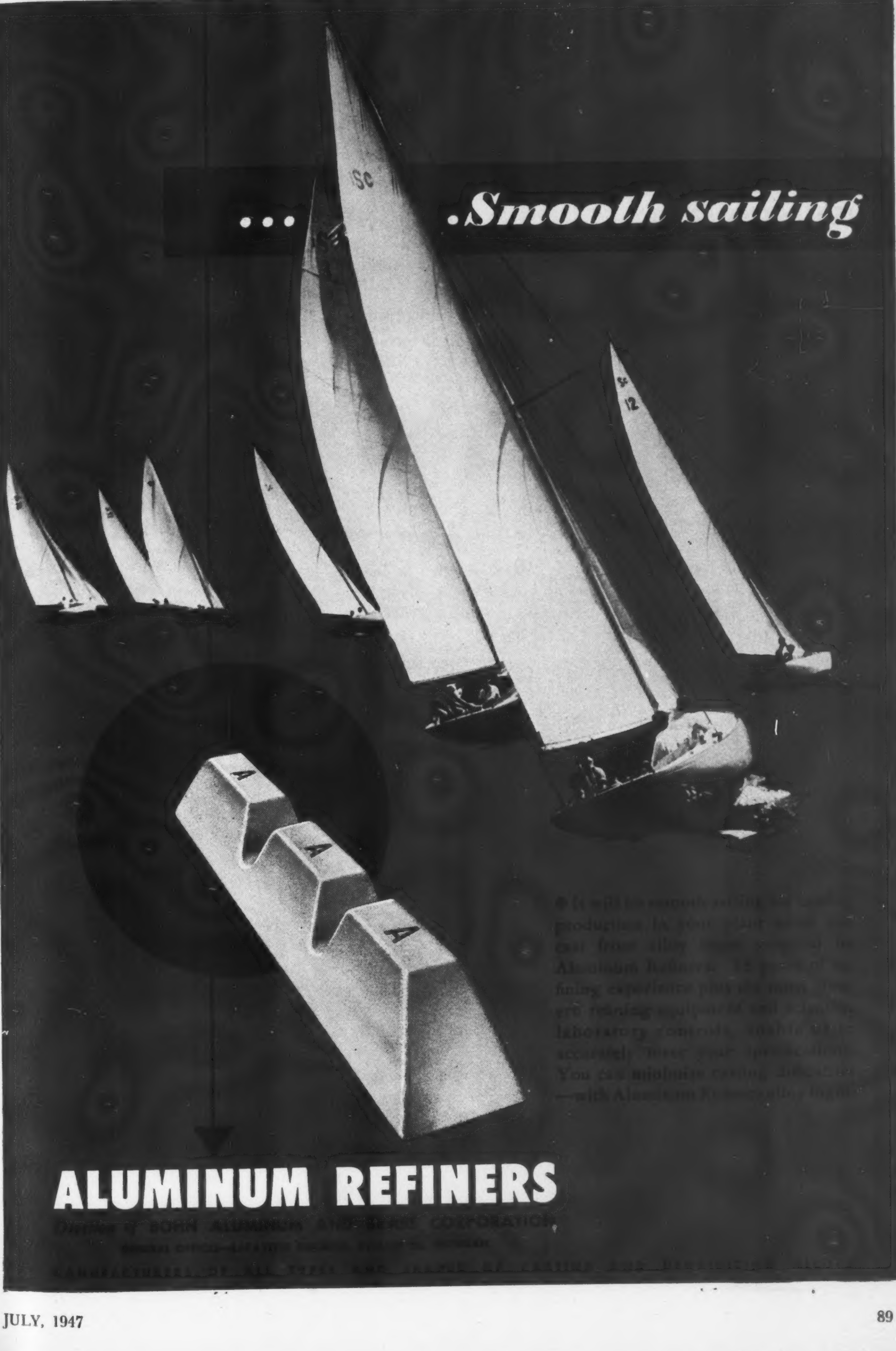
Georges Moressee, honorary president of the Association Technique de Fonderie de Belgique, died at Liege March 22.

An internationally recognized scientist, he had contributed to the fields of geology, physics, chemistry and metallurgy. For a long period of his career he was associated with the Societe d'Ougree-Marihaye as consulting engineer. A former president of the board of the Societe des Mines de Pyrites de Vedrin, Mr. Moressée was president of the board of the Societe des Compteurs et Manometres, Societe des Produits Chimiques de Vaux-sous-Chevremont and Societe Recsi.

He had served as president of the Liege section, Association of Engineers from the Liege School, and had been head of the metallurgy section of the association's Centennial Congress. Mr. Moressée received the gold medal of the A.I.Lg. in 1926 in recognition of his accomplishments.

Industrial Biographies

The Pennsylvania Historical Society and Museum of Commerce, State Museum Building, Harrisburg, Pa., is seeking biographies of Pennsylvania concerns for publication in a history of Pennsylvania industry. Such biographies should contain aproximately 1000 words, and illustrations of the old and the new are also acceptable. Pennsylvania foundry companies interested should communicate direct with Mr. S. K. Stevens, Historical Society and Museum of Commerce.


. . . .Smooth sailing
ALUMINUM REFINERS

CHAPTER ACTIVITIES

(Continued from Page 77)

W. H. Bowring, Frederic B. Stevens, Inc., Detroit, was elected *Chairman;* and A. W. Stolzenburg, Aluminum Co. of America, Detroit, was chosen *Vice-Chairman.*

Chapter *Secretary* R. E. Cleland, Eastern Clay Products, Inc., Detroit, was elected to another term.

Named *Treasurer* is G. A. Fuller, Federal Foundry Supply Co., also of Detroit.

Directors elected to serve for three years are E. J. Heiden, Riley Stoker Co.; E. J. Rousseau, Commerce Pattern Foundry & Machine Co.; C. B. Schneible, Claude B. Schneible Co., and E. H. Stilwill, Chrysler Corp., all of Detroit.

Western Michigan

K. C. McCready
Muskegon Piston Ring Co.
Chapter Reporter

Final meeting of the season for Western Michigan chapter was held in May at the Hotel Schuler, Grand Haven, with A. C. DenBreejen, Smith Oil & Refining Co., Rockford, Ill., as technical speaker.

Discussing "Practical Foundry Sand Problems," Mr. DenBreejen told the foundrymen that no one binder would satisfy all requirements in the foundry. Different types of jobs require specific binding agents, he pointed out. The speaker also cited examples of the application of different agents, and stressed, too, the advisability of exact measurement of binders. Weighing the binder used is preferred, he said.

Covering the subject of cores, Mr. DenBreejen brought out the necessity of supplying sufficient oxygen during baking. Heat alone, he explained, will not suffice to produce a proper core—enough oxygen must be present.

Edward Olson, Dake Engine Co., Grand Haven, introduced the speaker.

At the business session, the chapter held its annual election of officers and directors.

C. H. Cousineau, West Michigan Steel Foundry Co., Muskegon, who was Vice-Chairman for 1947-48, was named *Chairman* for next season.

The choice for *Vice-Chairman* was W. A. Hallberg, Lakey Foundry Co., Muskegon, who has served a year as Chapter Director.

D. A. Paull, Sealed Power Corp., Muskegon, and Charles Jacobson, Dake Engine Co., were elected *Secretary* and *Treasurer,* respectively.

Named *Directors* to serve for three years are Robert DeVore, Lakey Foundry Co.; V. A. Pyle, Pyle Pattern & Mfg. Co., who was Secretary for 1946-47, and Harold Bement, Campbell, Wyant & Cannon Foundry Co., all of Muskegon.

William Grant, Montague (Mich.) Castings Co., was elected a *Director,* to serve for two years, and W. R. Tuthill, American Seating Co., Grand Rapids, and R. F. Flora, Clover Foundry Co., Muskegon, retiring Chairman, *Directors* for one year.

Central Ohio
D. E. Krause
Battelle Memorial Institute
Chapter Reporter

SECTIONAL MEETINGS were featured at the technical session of the April 21 meeting of Central Ohio chapter. Tom Barlow, L. W. Eastwood and Schuyler Herres, of Battelle Memorial Institute were speakers.

Dr. Eastwood and Mr. Herres teamed up on the topic of "Gases in Metals" before the steel group. Laws and principles governing the behavior of gases in metals were outlined and discussed by Dr. Eastwood, and Mr. Herres then took up the specific effects as related to production of steel castings.

Inoculation Practice

Tom Barlow addressed the gray iron round table on "Practical Inoculation." He presented numerous practical illustrations of the benefits derived through proper inoculation practices, and brought his audience into an extended and interesting general discussion following his talk.

At the May 26 meeting, also held in the Chittenden Hotel, Columbus, Pat Dwyer, Penton Publishing Co., Cleveland, was the technical speaker and led a discussion on "Heading and Gating."

The business session took up the election of officers and directors.

R. H. Frank, Bonney-Floyd Co., Columbus, was named *Chairman.* He served as Vice-Chairman for the past twelve months.

F. W. Fuller, National Engineering Co., Columbus, who has served as a Director, is the new *Vice-Chairman.* D. E. Krause, Battelle Memorial Institute, Columbus, was named *Secretary.*

Named *Directors* for two-year terms are R. E. Fisher, Sr., Bonney-Floyd Co., and Walter Deutsch, Columbus Malleable Iron Co., Columbus, who completed a term as Treasurer this year.

Elected *Directors* to serve for one year are N. J. Dunbeck, Eastern Clay Products, Inc., Jackson, retiring Chapter Chairman; Karol Whitlatch, Aetna Fire Brick Co., Columbus, who has served as Secretary; Harry Watsmith, Jeffrey Mfg. Co., Columbus, and W. T. Bland, Commercial Steel Casting Co., Marion.

DIVISION DOINGS

Editor's Note: The reports of the committees shown below were taken from the minutes of the meeting. It is hoped that through these reports, that will be published from time to time in AMERICAN FOUNDRYMAN, the A.F.A. membership will be kept abreast of divisional and committee functions.

Brass and Bronze

Program and Papers Committee

THE 1947 convention program was discussed and it was the consensus of opinion that the roundtable meeting had been a tremendous success. However, it was thought that informal discussion rather than a prepared paper would promote more audience participation.

An attempt will be made to secure technical papers on the following subjects for the 1948 convention (1) foundry control of composition Navy M, (2) melting along the lines of H. Smith's roundtable luncheon talk presented at the 1947 meeting, and (3) operation and control of the Sklenar furnace.

Precision Investment Casting

A RESEARCH project on precision casting sponsored by the U. S. Department of Commerce is to be conducted at Armour Research Foundation. The need for research in this field to perfect existing processes and develop methods which will reduce the cost of the process and thereby expand this field of application was related in a letter to the Foundation endorsing the project by the committee.

In relation to the book that the committee is intending to publish, it was urged that the introductory chapter consist of (1) terminology or definition of terms, (2) historical review of the "lost wax" process and (3) analysis of the position of precision casting relative to other processes.

Concerning design and applications, several meetings were held at

(Concluded on Page 95)

Index to Advertisers

DIVISION DOINGS

(*Continued from Page 93*)

which tolerances and minimum hole size were discussed. It was concluded that no generalizations could be made on tolerances or other design factors because of the diversity of ideas and techniques in the plants. Several case histories of specific castings showing original design, design modifications, alloy selection and the final casting will appear in this chapter.

Subjects to be covered in the diemaking, patternmaking and spruing section of the book include, molds and mold making, devices for clamping molds, spruing and waxing.

The technique for the plaster type investment for non-ferrous alloys has been written by the investing, mold drying and heating sub-committee. This write-up covers such points as composition of the investment, storage conditions, mixing, vacuuming and physical properties associated with water-investment ratios. A description of ferrous investment techniques is being written and both the pre-coat and single type of investment will be included.

Sub-committee 3C, melting, casting and finishing, obtained a late start but an outline of the material to be written has been approved and individual assignments made. There will be a comprehensive discussion of casting machines and the four techniques of castings: centrifugal, pressure, gravity and vacuum.

Patents will be listed among the technical literature references to appear at the end of the book.

Malleable *

Business Meeting

AFTER REVIEWING the committee organization, it was the recommendation of those present that the standing committees remain as is, subject to the modification or approval of the incoming new chairman.

The necessity for early action on technical papers for next year's convention was stressed with a number of the committee promising papers.

A survey of literature on controlled annealing is being made.

* Officers elected for this division are reported in the June issue p. 48.


40 to 1 with Bayflex*
30 to 1
45 to 1
35 to 1
25 to 1
50 to 1
These are typical performance reports
we suggest you do a little arithmetic
Your Question:
If one Bayflex disc outperforms the ordinary coated abrasive disc 40 to 1, how much will I save per year?
In your calculation you may neglect the cost of our disc wheel. Its cost is completely absorbed in the waste time saved in changing 39 ordinary discs. Yes, turned into dollars, the saving in labor cost for slacking 39 nuts, removing 39 ordinary discs, replacing 39 ordinary discs, tightening 39 nuts — gives you our disc wheel free. Please do the arithmetic. The chances are better than 40 to 1 it will pay you handsomely to buy Bayflex.
Standard sizes in a range of grits available for stock shipment. Send for descriptive literature and prices.
Branch offices & warehouses
Chicago — Detroit
Distributors — All principal cities
BUILT-IN FLEXIBILITY — PLUS FOR MAXIMUM SAFETY AND CUTTING SPEED
A-24 J 16-F
BAYFLEX
Unexcelled for cleaning castings.
For welds on angle-iron frames.
For hard-to-get-at places.
Hundreds of uses in auto repair shops
Has no equal for smoothing welds.
BAY STATE
*Reg. U. S. Pat. Off. (Resilient Abrasive Wheels Mfd. by Bay State Abrasive Products Co.)
Top Performance Consistently Duplicated
BAY STATE ABRASIVE PRODUCTS CO. • WESTBORO, MASSACHUSETTS, U.S.A.